Manitoba
Agriculture

1987 Manitoba INSECT CONTROL GUIDE

87-03604/

1987

MANITOBA INSECT

CONTROL GUIDE

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INTRODUCTION

This Guide serves as a quick reference to the 1987 chemical insect control recommendations for Manitoba. It is intended for use by agricultural representatives, licenced pesticide dealers and commercial pesticide applicators.

Recommendations contained are based on those established by the Western Committee on Crop Pests and the Western Committee on Livestock Pests. The recommended insecticides have been selected for their effectiveness, availability, cost and safety. The number of insecticides recommended for the control of a specific insect have been kept to a minimum. Recommended insecticides are not necessarily the only ones which may be applied. Others may be applied, provided that the label carries a recommendation for the intended use.

Common names of insecticides are used throughout the Guide. Consult the list of common and trade names on page 11. Before using an insecticide, always consult the container label for directions and precautions.

INSECT IDENTIFICATION

Over a million and a half insect species are known in the world. Nature keeps insects in balance with the surroundings. But, often, man's interference and manipulation of nature causes certain insects to become economic pests. Presently, insecticides are the most effective means of combatting insect infestations.

Due to the number of species of insects, correct identification requires special training. Since some insecticides kill specific insect pests, proper identification of the insect to be controlled is very important. Insect identification services can readily be obtained by sending specimens to:

Entomology Section
Manitoba Department of Agriculture
911 Norquay Building
Winnipeg, Manitoba
R3C 0V8

Carefully pack specimens to ensure they arrive in proper condition.

RELATED PUBLICATIONS

More information on insects and their control may be obtained from these publications available through the Distribution Centre, Manitoba Department of Agriculture, 411 York Avenue, Winnipeg, Manitoba R3C 3M1.

Insect Control in the Home
Insect Control in the Home Garden
Insect Control on Fruit
Insect Control on Field Crops
Insect Control on Livestock
Insect Control on Ornamental Plants
Control of Insects and Mites in Farm Stored Grain
Grasshopper Control in Manitoba
Field Sprayers
European Corn Borer in Manitoba
Insecticides for Dairy Farms
Slug Control in Gardens

TOXICITY OF INSECTICIDES

This table rates the toxicity of insecticides recommended in this Guide. Some are extremely toxic to handle and use. Others, although less toxic, can be hazardous if carelessly applied. **The lower the LD^{50} the more toxic the insecticide.** Wear rubber gloves when handling and mixing any insecticide in concentrate form. An approved agricultural respirator and other protective equipment should be worn when handling, mixing or applying insecticides with an LD^{50} lower than 150. LD^{50} is defined as the amount of pure insecticide in mg/kg of body weight which will kill 50% of a test population.

ORAL LD_{50} RATINGS

INSECTICIDE	LD_{50}	HAZARD	INSECTICIDE	LD_{50}	HAZARD
aldicarb	1	VH	lindane	88	M
aluminum phosphide	1	VH	malathion	480-5800	M
azinphos-methyl	16.4	VH	methamidophos	18.9	VH
bendiocarb	34-64	H	metaldehyde	600-1000	L
carbaryl	560	L	methidathion	25-54	H
carbofuran	10	VH	methiocarb	135	M
chlordane	457-590	M	methomyl	17-26	VH
chlorfenvinphos	20	VH	methoxychlor	5000-7000	VL
chlorpyrifos	163	M	mevinphos	5-6.8	VH
coumaphos	90-100	M	naled	430	M
crotoxyphos	125	M	nicotine	50-60	M
cypermethrin	4123	L	parathion	13	VH
deltamethrin	135	M	permethrin	4000	L
diazinon	300-850	M	phosmet	230	M
dichlorvos	80	M	phorate	1.6-3.7	VH
dicofol	809	L	pirimicarb	147	M
dienachlor	3160	L	propoxur	100	M
dimethoate	215	M	pyrethrum	584-900	L
dioxacarb	60-80	M	resmethrin	4240	L
disulfoton	12.5	VH	ronnel	1500	L
endosulfan	110	M	rotenone	132-1500	M
ethylene dibromide	146	M	sulfotep	10	VH
fenbutatin oxide	2631	L	terbufos	4.5	VH
fensulfothion	2.2	VH	tetrachlorvinphos		
fenthion	215	M	(75% WP)	2420	L
fenvalerate	451	M	tetradifon	14700	VL
fonofos (10% Gran)	212	M	toxaphene	90	M
			trichlorfon	560-630	L

SOURCE: Guide to Chemicals Used in Crop Protection - Agric. Can. Pub. #1093

The estimated amount of active insecticide which would constitute a lethal dose when taken orally by a human adult is as follows:

TOXICITY RATING	AMOUNT OF ACTIVE INSECTICIDE	HAZARD RATING
less than 20	a few drops	Very High (VH)
21 - 50	up to 5 mL (1 tsp)	High (H)
51 - 500	5 - 50 mL (1 tsp - 2 tbsp)	Moderate (M)
501 - 5000	30 - 450 mL (1 - 16 oz)	Low (L)
more than 5000	more than 450 mL (16 oz)	Very Low (VL)

Where insecticides with a toxicity rating below 25 are used in crop protection, it is suggested that persons not enter sprayed areas for at least 24 hours unless suitable protective equipment and clothing is worn (see Safety Rules - page 6).

INSECTICIDE DRIFT

All insecticides are subject to some drifting, whether applied from the air or by ground equipment. Insecticide drift can cause serious contamination. Users should apply insecticide formulations less prone to drift. Pay particular attention to wind velocity, using insecticides only when wind is at a minimum (less than 12 km/hr).

SEED TREATING

Usually more seed is treated than sown in any particular year. It is extremely important that seed treated with insecticide be used for seeding only.

It is illegal to mix treated seed with grain to be used for human consumption.

Left-over treated seed cannot be used as feed for livestock of any type.

Left over treated seed should be properly tagged and stored for seeding later.

AERIAL SPRAYING

Unless otherwise specified in the recommendations, apply at least 12 L of spray solution per hectare (1 gal/ac) to ensure adequate distribution of insecticide. Higher volumes provide better coverage and better control of insect pests

Carry out aerial spraying only when wind velocity is below 12 km/hr (8 mph).

GROUND SPRAYING

Unless otherwise specified in the recommendations, 90 - 120 L water per ha (8-10 gal/ac) provides adequate insecticide distribution.

Ground spraying should take place when wind velocity is below 12 km/hr (8 mph).

INSECTICIDES AND POLLINATING INSECTS

The following points should be remembered when applying insecticides in the vicinity of pollinating insects.

- All insecticides are toxic to honeybees and other beneficial insects. Farmers, beekeepers, pesticide dealers and pesticide applicators must co-operate closely to minimize insect losses.
- Only the least toxic insecticides to bees should be used where honeybees or other pollinating insects may be foraging. Notify beekeepers in the area so they have an opportunity to protect their colonies.
- The application of insecticides during the early morning and late evening hours lessens the possibility of causing injury to honeybees and other pollinating insects.

Maximum times required for some of the commonly used insecticides to be reduced by weathering to a low hazard level to honeybees are shown in the table below.

FIELD APPLICATION HAZARD OF INSECTICIDES TO BEES[a]

Insecticide	Field Use[b]		Residue Hazard[c] (days)
	Honey bee	Leafcutter bee	
aldicarb	1	1	none
azinphos-methyl	1	1	5
Bacillus thuringiensis	3	3	none
bendiocarb	1	-	-
carbaryl	1	1	3-7
carbofuran F	1	1	5
carbofuran G	3	3	none
chlorofenvinfos	3	-	-
chlorpyrifos	1	1	3.5
deltamethrin	1	1	1.5
demeton	2	2	1
diazinon	1	1	2
dichlorvos	1	1	-
dicofol	3	3	none
dimethoate	1	1	7
endosulfan	2	1	2
fensulfothion	1	-	-
fenthion	1	-	-
fenvalerate	1	1	-

FIELD APPLICATION HAZARD OF INSECTICIDES TO BEES[a] (cont.)

Insecticide	Field Use[b] Honey bee	Leafcutter bee	Residue Hazard[c] (days)
fonofos	2	-	-
lindane	1	-	-
malathion	2	1	2
methamidophos	1	1	1
methidathion	1	1	-
methomyl	1	1	1.5
methoxychlor	2	2	.5
mevinphos	1	1	1.5
naled	2	2	1.5
oxydemeton-methyl	2	2	.5
permethrin	1	1	5
phosphamidon	1	1	5
pirimicarb	2	2	-
propoxur	1	1	-
pyrethrum	3	-	none
rotenone	3	-	none
tetradifon	3	2	.5
trichlorfon	2	2	.5

[a] Most of these chemicals have not been tested for bee toxicity under Western Canadian conditions; the data herein is for a general guideline only. Source: Atkins et al., Toxicity of Pesticides to Honey Bees, University of California, Co-op. Extension 170, 1974

[b] Field application where bees are, or will be foraging
1. Very poisonous to bees; do not apply to crops or weeds in bloom unless bees are kept off for the period that residue on the crop is a hazard
2. Moderately poisonous to bees; may be applied in the evening when bees are not foraging
3. Not very poisonous to bees; may be applied with minimum hazard to bees

[c] Residue hazard; represent the average time in days that residue poisonous to bees will remain on the foliage. - indicates no data available

HOW INSECTICIDES KILL

Insecticides enter an insect's body by contact on its outer shell or by ingestion, and kill by disruption of its nervous system.

Most insecticides, formulated for use as sprays, directly contact the insect on application or have residual contact for a time after application. Most major crop insect pests such as grasshoppers, armyworms, flea beetles and aphids are killed by direct or residual contact from spray applications of insecticides.

Some insecticides are formulated for specialized uses, killing specific insects in specific ways. Common examples are systemic pour-on insecticides for warble grub control in cattle, tree-trunk band applications for aphid control and granular or powder formulations for seed treatments for flea beetle control on canola. Other examples of specialized insecticides are scatter baits for farm fly control, fumigants for stored grain insect control and insecticide impregnated resin strips for indoor fly control. Insecticides, whether a direct spray or more specialized application have the end result of being absorbed through insects' outer shell or ingested by feeding causing death by disruption of the nerve processes.

COMPATIBILITY OF INSECTICIDES AND OTHER PESTICIDES

In Manitoba one insecticide will usually combat an insect problem. However, insecticides and fungicides are frequently used together, especially by market gardeners.

In general, most pesticides used in Manitoba are compatible when mixed with another pesticide.

It may be advantageous at certain times to mix an insecticide with a herbicide for insect control on a limited area basis, but it is not recommended as a general practice for the following reasons:

1. Insect and weed problems seldom warrant control at the same time. Waiting to take control of both pests is likely to result in poor control of either or both.
2. Insect problems are specific and often on a limited crop area. Thus, using two pesticides together may result in high costs for unwarranted insecticide.
3. Delays after mixing, because of mechanical or other reasons, can result in loss of effectiveness.

Persons using two or more pesticides together should be advised to take the following precautions:

1. Use products formulated by the same company.
2. Obtain compatibility information from pesticide manufacturer if possible.
3. Apply chemical as soon as possible after mixing.

WATER pH AND INSECTICIDE DEGRADATION

When certain insecticides are added to alkaline water (high pH), they begin to lose their effectiveness. The rate at which degradation proceeds depends on several factors. These include the pH of the water, the amount of insecticide being added and its effect on the pH of the finished spray, water temperature and the length of time the finished spray is allowed to stand.

In general, alkaline hydrolysis affects pesticides classified as organo-phosphates and carbamates. Some pyrethroids are also known to be similarly affected.

One thing to be aware of is that pesticide degradation (hydrolysis) in alkaline solutions is irreversible and initial effectiveness is lost.

The effect of alkalinity applies only while the mixture remains in the tank. The persistence of a pesticide is not affected by water pH after it is sprayed. It is very important therefore to spray the pesticide as soon as possible after mixing.

METHODS OF CALCULATING AMOUNT OF INSECTICIDE REQUIRED

Application accuracy is important. Uneven application or wrong dosage can be costly. Applying more than the recommended amount increases costs and may make crops unfit for sale or use because of a high residue. Less than the recommended amount may result in poor control, and poor control of the pest may result in heavy crop damage.

Recommendations for spraying livestock and buildings are often given as percent of finished spray or as kg of insecticide formulation per number of litres of water. It is often desirable to obtain the same strength spray using a different formulation or different amount of water. The following formulae may be used in making these calculations.

1. How to calculate the amount of emulsifiable concentrate needed to mix a spray containing a given percentage of active toxicant.

FORMULA:

$$\frac{\text{litres spray needed} \times \%\ \text{toxicant required}}{\text{kg of toxicant/litre of emulsifiable} \times 100}$$

EXAMPLE: - Metric

How much 50% malathion (500 g/L) is needed to make 50 L of 0.5% malathion?

$$\frac{50 \times 0.5}{0.5 \times 100} = \frac{25}{50} = 0.5 \text{ litres of 50\% malathion}$$

EXAMPLE: - Imperial

$$\frac{\text{gal spray needed} \times \%\ \text{toxicant required} \times 10}{\text{pounds of toxicant per gal of emulsifiable} \times 100}$$

How much 50% malathion (5 lb/gal) is needed to make 10 gal of 0.5% malathion?

$$\frac{10 \times 0.5 \times 10}{5 \times 100} = 0.1 \text{ gal and fill to 10 gal}$$

2. How to calculate the amount of wettable powder needed to mix a spray containing a given percentage of toxicant.

FORMULA:

$$\frac{\text{litres spray needed x \% toxicant required}}{\%\ \text{toxicant used}}$$

EXAMPLE: - Metric

How many kg of 25% WP methoxychlor are needed to make 450 L of spray containing 0.5% toxicant.

$$\frac{450\ \text{L} \times 0.5}{25} = 9\ \text{kg}$$

EXAMPLE: - Imperial

$$\frac{\text{gal spray needed} \times \%\ \text{toxicant required} \times 10}{\%\ \text{toxicant used}}$$

How many lb of 25% wettable powder methoxychlor are needed to make 100 gal of spray containing 0.5% toxicant?

$$\frac{100 \times 0.5 \times 10}{25} = 20\ \text{lb}$$

3. How to figure percent active toxicant in a spray mixture.

FORMULA:

$$\frac{\text{kg used} \times \%\text{ active ingredient in insecticide}}{\text{L spray mixture}}$$

EXAMPLE: - Metric

4.5 kg of 50% methoxychlor wettable powder were mixed in 225 L of water. What % active methoxychlor was in spray?

$$\frac{4.5\text{ kg} \times 50}{225\text{ L}} = 1\%\text{ active methoxychlor}$$

EXAMPLE: - Imperial

$$\frac{\text{lb of insecticide used} \times \%\text{ active ingredient in insecticide}}{\text{gal of spray mixture} \times 10}$$

EXAMPLE: - Imperial

10 pounds of 50% methoxychlor wettable powder were mixed in 50 gal of water. What % active methoxychlor was in the spray?

$$\frac{10 \times 50}{50 \times 10} = 1\%\text{ active methoxychlor}$$

SPRAYER CALIBRATION

1. Measure off a known distance; the number of metres (feet) of travel to spray one hectare (acre) or a fraction thereof.
2. Fill your supply tank full of water.
3. Spray the measured distance as you would spray the field. Note speed of tractor and pressure of sprayer.
4. Carefully measure the number of litres (gallons) of water required to refill the tank. This is the volume sprayed.
5. Convert the volume sprayed to volume per hectare (acre) delivered by the sprayer at a given speed and pressure.
6. The volume per hectare (acre) delivered divided into the volume of the tank will give the number of hectares (acres) a tankfull of spray will cover. This is the hectare (acre) capacity of the tank at that pressure and speed and for the type of boom used.
7. Add the amount of insecticide recommended per hectare (acre), multiplied by hectare (acre) capacity of the tank, to the empty tank and refill with water.

If the field is sprayed at the same speed and sprayer pressure, the required amount of insecticide per hectare (acre) will be delivered. Changes in the pressure or speed will change the calibration of the sprayer. For more complete information refer to Manitoba Agriculture Bulletin "Field Sprayers" Agdex 744-1, 1982.

HOW TO CLEAN A CONTAMINATED SPRAYER

Sprayers contaminated with herbicides can be used for insecticides without danger to susceptible crops, provided the following cleaning procedures are carried out:

1. Fill and flush out the sprayer three times using clean water.
2. Fill the tank with a mixture of 1 litre warm water and 20 mL household ammonia (1 cup ammonia to 3 gallons of water). Allow this mixture to stand in the tank for 1 to 2 days and then run it through the machine. More rapid results can be obtained if household ammonia is used with steam.
3. Wash out the sprayer with soapy water and rinse again with clean water.

SAFETY IN HANDLING AND APPLYING PESTICIDES

Poisoning

The two types of poisoning are acute and chronic. Acute poisoning occurs from a single dose of pesticide. Chronic poisoning results from several small exposures over a period of time. Chronic poisoning may become acute if exposure is allowed to continue. It is more dangerous as symptoms can be confused with a cold or other common ailment. If symptoms such as headache, nausea or dizziness occur after exposure to an insecticide, see a doctor immediately, taking a container label with you. Some pesticides normally low in toxicity become much more toxic when used in combination with other pesticides.

Safety Rules

Insecticides may enter the body through the skin, the mouth and by breathing the vapors. These three pathways are to be considered when handling pesticides. The following precautions should be observed at all times but particular care must be taken when handling the concentrated pesticide during mixing operations.

1. Read the label on the container. This may save your life and prevent accidents. It will name the product and its most effective use. It will also explain how to handle the material and what should be done in the case of an accident.

2. When mixing spray solutions wear PVC hat, gloves and apron as well as chemical goggles, coveralls and NIOSH (National Institute of Occupational Safety and Health) approved dual cartridge agricultural respirator with pesticide cartridge.
3. When mixing seed treatments with seed, always wear goggles, respirator, gloves and arm protection such as a jacket.
4. Never mix spray solutions or treat seed inside a building. Do it outside so that the vapors can blow away.
5. Wear clean clothes each day when using pesticides.
6. Shower each day after using pesticides.
7. If insecticides are spilled on the skin, wash immediately and thoroughly with soap and water.
8. Change contaminated clothing as soon as possible and wash before re-use.
9. While spraying or dusting, prolonged exposure should be avoided; sprays and dusts should not be inhaled, smoking (especially handrolled cigarettes) should be avoided and all exposed parts of the body should be washed immediately after.
10. If you are taking drugs at the same time you are using pesticides, notify your doctor, since exposure to pesticides may alter the effectiveness of a drug.
11. Exercise care and caution when using pesticides, you may save a life or prevent serious illness.
12. If symptoms such as nausea, headache, blurred vision, numbness in fingers occur when using pesticides, see a doctor immediately. Take the pesticide container label with you, it will aid the doctor in his treatment.
13. Take care not to contaminate feed or water for livestock. The rates of application on the labels should be followed, and the cautions with regard to the use of treated crops strictly observed.

CONTAMINATION OF WELLS, DUGOUTS AND OTHER WATER SOURCES

Use extreme care to avoid accidental spilling of any pesticide into wells, dugouts or other water sources used for human and livestock consumption. Observe the following precautions:

1. If possible, do not fill sprayers directly from wells, dugouts, etc. The use of portable water storage tanks will allow water to warm to air temperature for better mixing and eliminates the possibility of contamination of water supplies.
2. If a sprayer must be filled directly from a well, dugout or similar source, the sprayer intake hose should be removed from the water source before the sprayer pump is stopped. This will prevent backsiphoning of chemical from the sprayer to the water source.

RESPIRATORS AND THEIR CARE

Recommended respirators are the dual cartridge agriculture type that have NIOSH approval. The proper cartridge to use will vary depending on the make. When purchasing a respirator ensure that the proper cartridge is obtained by specifying that it is to be used with pesticides.

To be completely reliable, respirators must be properly looked after. The following procedures are recommended:

1. Filters should be changed twice a day or more often if breathing becomes difficult.
2. Cartridges should be changed after eight hours of use or more often if any pesticide is detected.
3. Filters and cartridges should be removed and the face piece should be washed with soap and water after use. Rinse to remove traces of soap. Face piece should be dried with a clean uncontaminated cloth and then placed in a well ventilated area to dry.
4. When not in use respirators, filters and cartridges should be placed inside an airtight plastic bag and stored in a clean, dry place.

STORAGE OF INSECTICIDES

Store insecticides in a special area which is not normally used by anyone. It should be a warm location to prevent freezing of the insecticide. Labelling and locking of this area is advisable.

Store pesticides in their original containers with label intact. Avoid causing dents or scratches which will weaken the container possibly causing leaks. Dispose of leaking containers.

DISPOSAL OF CONTAINERS AND SURPLUS SPRAY

1. **Containers** - paper or cardboard cartons may be burned on a hot fire composed of wood soaked in diesel fuel. The temperature generated by an ordinary fire is not sufficient to ensure decomposition. REMEMBER THAT SMOKE FROM PESTICIDE FIRES MAY BE TOXIC. DO NOT

ALLOW SMOKE TO DRIFT OVER PEOPLE, LIVESTOCK OR BUILDINGS.

- glass or metal containers must be decontaminated by rinsing thoroughly two or three times with a solution of equal parts chlorine bleach (ie. Javex) and water. The containers should then be broken or punctured and taken to the municipal dump for burial.

2. SURPLUS SPRAY MIXTURE - the best known method of disposing of surplus spray mixture is to spray it out in a specific area set aside for this purpose.
3. OLD OR UNWANTED INSECTICIDE - Contact the Manitoba Department of Agriculture, Entomology Section at 945-3857 in Winnipeg.

CLEANING UP SPILLS

Personal Protection and Cleanup Equipment

1. Broom
2. Shovel
3. Coveralls
4. Heavy rubber or P.V.C. gloves and boots
5. Respirators, dual cartridge agricultural type with pesticide cartridge
6. Hydrated lime - 2, 50 lb bags
7. Laundry bleach - 2 gallons of Javex or Chlorox
8. Caustic soda or lye
9. Heavy gauge plastic bags

When cleaning up any insectide, coveralls, rubber gloves and boots should be worn.

When cleaning up moderately to very toxic chemicals, wear a respirator as well. These chemicals include: carbofuran, azinphos-methyl, methomyl, lindane, chlorpyrifos, endosulfan and methamidophos.

If chemical is spilled on clothing, or comes in contact with skin, immediately remove clothing and wash skin with soap and water. The clothing should be washed before being worn again.

Liquid spills

1. Spread hydrated lime over spill in sufficient quantity to soak up liquid.
2. Allow it to sit until all liquid is soaked up.
3. Sweep up and place in heavy gauge plastic bag.
4. Soak entire area with laundry bleach (Javex or Chlorox) and spread more lime over the area.
5. Allow one or two hours for decomposition.
6. Sweep up and place in same heavy gauge plastic bags.
7. Remove sweepings to municipal dump for burial.

Dry powder

The procedure is the same as for liquid, except that the powder will have to be wetted before embarking on cleanup.

IN CASE OF PESTICIDE POISONING CONTACT:

POISON CONTROL CENTRE
Winnipeg Health Sciences
Children's Centre
685 Bannatyne Avenue
787-2591

WASHING CONTAMINATED CLOTHING

Pesticides can present a problem when spilled onto clothing. Residues on clothing can be absorbed through the skin to cause unwanted reactions. Special laundering procedures are required to remove the chemicals from the clothing to prevent skin reactions or contamination of other clothing.

Clothes with chemicals on them must be handled with care. Neoprene gloves will prevent absorption as the highly contaminated clothing is handled for laundering. If clothes have been completely saturated with a chemical, discard.

Daily laundering may be necessary during times when chemicals are used on a daily basis.

Before washing, rinse clothing by presoaking in a suitable container, agitating in an automatic washer or spraying the garment outdoors with water. Wash only one or two garments at a time in lots of water. The clothes must be free for movement to work the chemical out of the clothing.

Use hot water (60 degrees C/140 degrees F) with the machine set at full water level and a normal wash cycle (about 12 minutes). Cold water temperatures are relatively ineffective in removing chemicals from clothing. Re-wash the clothes two or three times to be sure that all the chemicals are removed.

All laundry detergents are effective in removing chemicals from fabric, but heavy-duty liquid detergents are more effective in removing oil-based chemicals. Laundry additives such as bleach or ammonia will contribute to the removal of chemical

residues, however, use only one at a time. Never mix bleach and ammonia.

Rinse the washing machine thoroughly after laundering contaminated clothing. Use hot water and the same detergent, machine settings and cycles used for laundering the contaminated clothing.

Line dry clothing to avoid contamination of the dryer. Sunshine will break down many chemicals.

Special attention to laundering chemical contaminated clothing will prevent unwanted skin irritations and contamination of other clothes.

CHOLINESTERASE TESTS

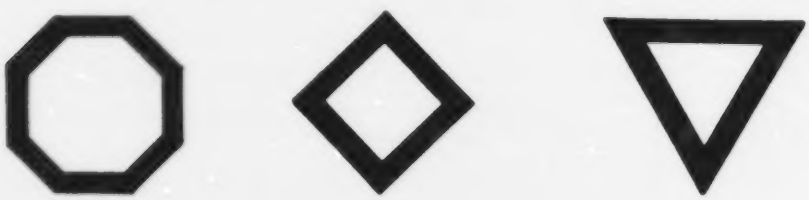
Organophosphate insecticides are cholinesterase inhibitors which, if inhaled or absorbed through the skin, can cause poisoning. A reduction in the amount of cholinesterase in the blood may indicate poisoning.

To guard against organophosphate poisoning, blood tests are taken to measure cholinesterase levels. Tests should be taken at the beginning and periodically throughout the spray season. Your physician will record your blood cholinesterase level and contact you if a change occurs. If a decrease in your level occurs, it indicates insecticide is entering your bloodstream. Remedial action to prevent further exposure must be taken immediately. For further information on arranging cholinesterase tests contact Entomology Section, Manitoba Agriculture, phone, 945-3860.

CLASSIFICATION OF PESTICIDES

Pesticides are classified according to the use hazard and risk involved. The categories of hazard: toxicity, flammability, explosive potential and corrosivity and the degree of risk is represented by symbols taken from common traffic sign shapes represented by the stop, caution and yield signs. The signal word for each of the signs is danger, warning and caution. Where the risk is minimal no designation is required. The label on Control Products will carry these signs for the protection of the user. When a product is registered, its properties will be checked and it will be classified and categorized according to these properties. The symbols are listed below:

Degree of Risk Symbols



Danger *Warning* *Caution*

Category of Hazard Symbols

Poison *Corrosive* *Flammable* *Explosive*

COMMON AND TRADE NAMES OF INSECTICIDES

(Trade Names Capitalized)

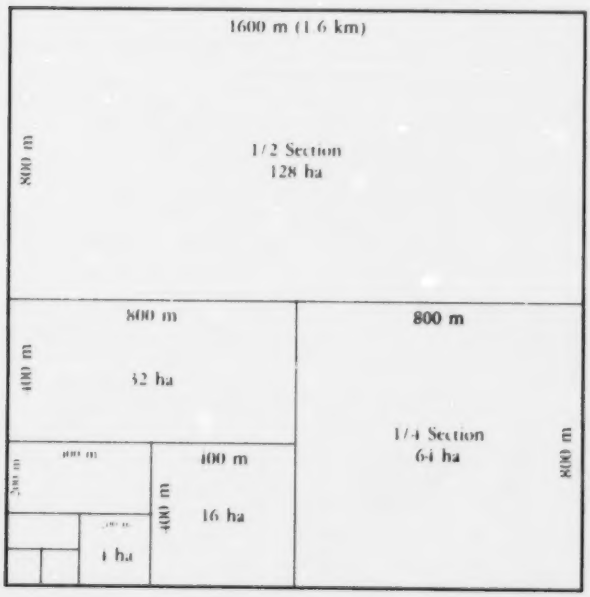
aldicarb - Temik
aluminium phosphide - Phostoxin
Ambush - permethrin
Atroban-permethrin
azinphos-methyl - Guthion
Bacillus thuringiensis - Dipel
- Thuricide
Baygon - propoxur
Baytex - fenthion
Belmark - fenvalerate
bendiocarb - Ficam
borax
Birlane - chlorfenvinphos
carbaryl - Sevin
carbofuran - Furadan
chlordecone
chlorfenvinphos - Birlane
chlorpyrifos - Dursban
- Lorsban
Ciodrin - crotoxyphos
Ciovap - crotoxyphos-dichlorvos
Co-Ral - coumaphos
coumaphos - Co-Ral
Counter - terbufos
crotoxyphos - Ciodrin
crotoxyphos-dichlorvos - Ciovap
Cygon - dimethoate
Cymbush - cypermethrin
cypermethrin - Cymbush
- Ripcord
- Stockaid
Cythion - malathion
Dasanit - fensulfothion
DDVP - dichlorvos
Decis - deltamethrin
deltamethrin - Decis
diazinon
Dibrom - naled
dichlorvos - Vapona
dicofol - Kelthane
dienochlor - Pentac
dimethoate - Cygon, System
Dipel — Bacillus thuringiensis
disulfoton - Di-Syston
Di-Syston - disulfoton
Disvap-tetrachlorvinphos
Dursban - chlorpyrifos
Dyfonate - fonofos
Dylox - trichlorfon
Ectiban - permethrin
endosulfan - Thiodan
ethylene dibromide
ethylene dichloride
famphur-warbex
fenbutatin-oxide - Vendex
fensulfothion - Dasanit
fenthion - Baytex
- Spotton
- Tiguvon
- Lysoff
fenvalerate - Belmark
Ficam - bendiocarb
fonofos - Dyfonate
Furadan - carbofuran
Guthion - azinphos-methyl
Imidan - phosmet
Ivermectin-Ivomec
Kelthane - dicofol
Lannate - methomyl
lindane
Lorsban - chlorpyrifos
Lysoff - fenthion
malathion - Cythion
Mesurol - methiocarb
metaldehyde
methamidophos - Monitor
methidathion - Supracide
methomyl - Lannate
methoxychlor
mevinphos - Phosdrin
Monitor - methamidophos
naled - Dibrom
napthalene
Neguvon - trichlorfon
parathion
Pentac - dienochlor
permethrin - Ambush
- Ectiban
- Pounce
- Sanbar
- Sentinel
- Talcord
- Atroban
phorate - Thimet
Phosdrin - mevinphos
phosmet - Prolate
- Imidan
Phostoxin - aluminum phosphide
piperonyl butoxide
pirimicarb - Pirimor
Pirimor - pirimicarb
Prolate - phosmet
propoxur - Baygon
pyrethrum
resmethrin
rotenone
Ripcord - cypermethrin
Sanbar - permethrin
Sentinel - permethrin
Sevin - carbaryl
Spotton - fenthion
Stockaid - cypermethrin
Supracide- methidathion
Tedion - tetradifon
Temik - aldicarb
terbufos - Counter
tetrachlorvinphos-Disvap
tetradifon - Tedion
Thimet - phorate
Thiodan - endosulfan
Thuricide - Bacillus thuringiensis
Tiguvon - fenthion
trichlorfon - Dylox
- Neguvon
Vapona - dichlorvos
Vendex - fenbutatin-oxide
Warbex-famphur

ABBREVIATIONS

L - liquid
PO - pour on
PCO - pest control operator
ULV - ultra low volume
WP - wettable powder
SC - spray concentrate
E - emulsifiable
S sprayable powder
SP - soluble powder
EC - emulsifiable concentrate
D - dust
G - granular
LS - liquid solution
C - concentrate

ACRES TO HECTARES

Acres can be converted to hectares by dividing acres by 2.5.



METRIC CONVERSION FACTORS

Symbols

Length
mm - millimetre
cm - centimetre
m - metre
km - kilometre

Area
m^2 - square metre
ha - hectare

Weight
mg - milligram
g - gram
kg - kilogram
t - tonne

Volume
mL - millilitre
L - litre
m^3 - cubic litre

Pressure
kPa - kilopascal

Temperature
°C - degree Celsius

Relationships

Length
10 mm = 1 cm
100 cm = 1 m
1000 m = 1 km

Area
10 000 m^2 = 1 ha

Weight
1000 mg = 1 g
1000 g = 1 kg
1000 kg = 1 t

Volume
1000 mL = 1 L
1000 L = 1 m^3

Length
1 in = 2.54 cm
1 ft = 0.3048 m
1 yd = 0.914 m
1 mile = 1.609 km
1 m = 1.09 yd
1 m = 3.28 ft

Area
1 sq in = 6.452 cm^2
1 sq ft = 0.093 m^2
1 sq yd = 0.836 m^2
1 acre = 0.4047 ha
1 sq mile = 256 ha
1 ha = 2.47A (round to 2.5 in most cases)
1 m^2 = 10.8 ft^2
1 m^2 = 1.2 yd^2

Weight
1 oz = 28.35 g
1 lb = 0.4536 kg
1 ton = 0.907 t
1 kg = 2.20 lbs

Volume
1 fl oz = 28.41 mL
1 fl oz (US) = 29.57 mL
1 pint = 0.568 L
1 quart = 1.137 L
1 gal = 4.546 L
1 US gal = 3.785 L
1 cu in = 16.387 cm^3
1 cu ft = 0.028 m^3
1 cu yd = 0.765 m^3
1 L = 0.88 qt
1 L = 0.22 gal
1 m^3 = 35.71 ft^3
1 m^3 = 1.31 yd^3

Proportion
1 fl oz/acre = 70.21 mL/ha
1 oz/acre = 70.07 g/ha
1 lb per acre = 1.121 kg/ha
1 lb/in^2 (psi) = 6.895 kPa
1 pint/acre = 1.40 L/ha
1 qt/acre = 2.81 L/ha
1 gal/acre = 11.23 L/ha
1 kg/ha = 0.89 lb/A
1 L/ha = .089 gal/acre

Temperature
°C = 5/9 (°F - 32)
°F = 9/5 °C + 32

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Freshening	Restrictions
DAIRY CATTLE					
Horn fly (apply insecticides when populations exceed 20 per animal)	carbaryl	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP/100 L water & apply over entire body.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP/10 gal water & apply over entire body.	7	
	coumaphos	Apply up to 60 g/animal of 1% dust into the hair on head, neck, shoulders and back.	Apply up to 2 oz/animal of 1% dust into the hair on head, neck, shoulders and back.	0	Do not repeat application within 10 days. Treat lactating dairy cows only after milking.
	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray to dampen the hair on flanks, legs, brisket, head and neck.	Apply as a coarse ready-to-use spray to dampen the hair on flanks, legs, brisket, head and neck.	0	
	cypermethrin (ear tags)	**Apply 1 tag/animal.**	**Apply 1 tag/animal.**	**0**	
	fenvalerate (ear tag)	Apply 1 Bovaid ear tag on flat surface of ear per animal. For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	Apply 1 Bovaid ear tag on flat surface of ear per animal. For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	0	Remove tags before slaughter.
	permethrin	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water & apply 1 - 2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 25 gal water & apply 1 - 2 qt/animal over entire body.	30	
	permethrin (ear tag)	Apply 1 Atroban ear tag on flat surface of ear **per animal.**	Apply 1 Atroban ear tag on flat surface of ear **per animal.**	0	Remove tags before slaughter. Do not treat calves under 6 months.
	permethrin (ear tag tape)	**Apply 1 ear tag tape/ animal**	**Apply 1 ear tag tape/ animal**	**0**	
	pyrethrin	Apply ready-to-use sprays daily to sides, back and underline.	Apply ready-to-use sprays daily to sides, back and underline.	0	Wash udder before milking.
	tetrachlorvinphos (ear tag)	**For best results apply 2 Disvap ear tags per animal.**	**For best results apply 2 Disvap ear tags per animal.**	0	Remove tags before slaughter. Do not treat calves under 6 months.
Face fly	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray to animal's face once or twice/day.	Apply as a coarse ready-to-use spray to animal's face once or twice/day.	0	
	cypermethrin (ear tag)	**Apply 2 ear tags/animal.**	**Apply 2 ear tags/animal.**	**0**	

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Freshening	Restrictions
Face fly cont.	fenvalerate (ear tag)	Apply 1 Bovaid ear tag on flat surface of each ear (two tags per animal). For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	Apply 1 Bovaid ear tag on flat surface of each ear (two tags per animal). For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	0	Remove tags before slaughter.
	permethrin	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water & apply 1 - 2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz of 25% EC/25 gal water & apply 1 - 2 qt/animal over entire body.	30	For non-lactating dairy animals only.
	permethrin (ear tags)	**Apply 2 ear tags/animal.**	**Apply 2 ear tags/animal.**	**0**	
	tetrachlorvinphos (ear tag)	For best results apply 2 Disvap ear tags per animal.	For best results apply 2 Disvap ear tags per animal.	0	Remove tags before slaughter. Do not treat calves under 6 months.
Mosquitoes	dichlorvos	Apply as a coarse ready-to-use spray to dampen hair.	Apply as a coarse ready-to-use spray to dampen hair.	0	
	pyrethrin	Apply ready-to-use e-sprays daily to sides, back & underline.	Apply ready-to-use sprays daily to sides, back & underline.	0	Wash udder before milking.
Black flies	permethrin	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water & apply 1 - 2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 25 gal water & apply 1 - 2 qt/animal over entire body.	30	For non-lactating dairy animals only.
Lice	carbaryl	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP in 100 L water and apply as a spray over entire animal.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water & apply as a spray over entire animal.	7	
	coumaphos	Dust with 1% ready-to-use dust to all infested parts of body.	Dust with 1% ready-to-use dust to all infested parts of body.	0	
	crotoxyphos	Apply 15 - 30 g of 3% dust/head for small and 30 - 60 g/head for large animals. Repeat in 2 - 3 weeks if required.	Apply 1-2 oz of 3% dust/head for small and 2-4 oz/head for large animals. Repeat in 2-3 weeks if required.	0	
	Ivermectin	**Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.**			**Follow label precautions and wait periods. For non-lactating dairy cattle only.**

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Freshening	Restrictions
Lice cont.	rotenone	Apply 1% dust to point of visible cover.	Apply 1% dust to point of visible cover.	0	Rotenone is highly toxic to hogs. Hogs should not be in area of treatment.
	permethrin	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water.	Mix 1 qt. of 50% EC or 8 fl oz 25% EC/ 25 gal water.	30	
Cattle grub (non-lactating dairy cattle)	coumaphos	Apply as a high pressure spray at a rate of 2 kg 25% WP in 100 L of water and 4.5 L mixture/animal.	Apply as a high pressure spray at a rate of 2 lb 25% WP in 10 gal water and 1 gal mixture/animal.	14	If freshening should occur within 14 days after treatment, do not use the milk for human consumption for the balance of the 14 day interval. Do not apply more than once/ season; to sick animals, or animals less than 3 months of age. Avoid application during Dec., Jan. or Feb.
	famphur	Apply as a ready-to-use pour-on or injectable.	Follow all restrictions on label.		
	fenthion	Apply Spotton with special applicator at 4 mL/136 kg body weight. Apply on one spot on the backline of the animal.	Apply Spotton with special applicator at 4 mL/300 lb body weight. Apply on one spot on the backline of the animal.	10	If freshening occurs within 10 days after treatment, do not use milk for human consumption for balance of the 10 day period. Do not apply during Dec., Jan. or Feb. Do not apply to sick animals, or animals under 3 months of age.
	Ivermectin	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.			Follow label precautions and wait periods.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Freshening	Restrictions
Cattle grub (non-lactating dairy cattle) cont.	trichlorfon	Pour-on at the rate of 15 mL 8% Pour-on/ 45 kg body weight.	Pour-on at the rate of ½ fl oz 8% Pour-on/ 100 lb body weight.	7	If freshening occurs within 7 days, do not use milk for human consumption for 7 days after treatment. Do not treat sick animals, or calves under 3 months of age. Avoid application in Dec., Jan. or Feb.
Cattle Grub (lactating dairy cattle)	rotenone	Apply ready-to-use dust at intervals of 2 - 4 weeks. Rub insecticide in the warble holes with a stiff brush before larvae drop.	Apply ready-to-use dust at intervals of 2 - 4 weeks. Rub insecticide in the warble holes with a stiff brush before larvae drop.	0	
Stable fly (apply insecticides when populations exceed 25 per animal)	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray to dampen hair on flank, brisket, legs, head and neck.	Apply as a coarse ready-to-use spray to dampen hair on flank, brisket, legs, head and neck.	0	
BEEF CATTLE					
Horn fly (apply insecticides when populations exceed 40 per animal)	carbaryl	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP/100 L water & apply as a spray over entire body.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water & apply as a spray over entire body.	7	
	coumaphos	Apply up to 60 g of 1% dust/animal into the hair on head, neck, shoulders and back.	Apply up to 2 oz of 1% dust/animal into the hair on head, neck, shoulders and back.	0	**Do not repeat application within 10 days. Do not inhale dust or get it in eyes or skin.**
	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray. Spray should dampen the hair on flanks, legs, brisket, head and neck. OR Use in backrubber device at the rate of 4.5 L ready-to-use mixture for each 6 m of cable. Backrubber should be kept full at all times.	Apply as a coarse ready-to-use spray. Spray should dampen the hair on flanks, legs, brisket, head and neck. OR Use in backrubber device at the rate of 1 gallon ready-to-use mixture for each 20 ft of cable. Backrubber should be kept full at all times.		

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Horn fly cont.	cypermethrin (ear tag)	Apply 1 ear tag/animal.	Apply 1 ear tag/animal.	0	
	fenvalerate (ear tag)	Apply 1 Bovaid ear tag on flat surface of ear. For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	Apply 1 Bovaid ear tag on flat surface of ear. For maximum benefit apply early each spring before activity begins. Treat entire herd.	0	Remove tags before slaughter.
	methoxychlor	Apply as a high pressure spray at the rate of 0.5 kg 50%WP in 45 L water and 2.2 L mixture per animal.	Apply as a high pressure spray at a rate of 1 lb 50% WP in 10 gal water and 2 qt of mixture/animal.	-	Do not treat sick animals or animals under 1 month of age.
	malathion	Use in backrubber at rate of 4 L 50% EC/96 L fuel, diesel or mineral oil.	Use in backrubber at rate of 1 gal. 50%EC/22 gal. fuel, diesel or mineral oil.		Do not treat animals under 1 month of age.
	permethrin	Mix 1 L of 5% EC or 200 mL of 25% EC/ 400 L water & spray entire animal.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 100 gal water & spray entire animal.	-	
	permethrin (ear tag)	Apply 1 Atroban ear tag on flat surface of ear/ animal.	Apply 1 Atroban ear tag on flat surface of ear/ animal.	0	Remove tags before slaughter. Do not treat calves under 6 months.
	permethrin (ear tag tape)	Apply 1 ear tag tape/ animal.	Apply 1 ear tag tape/ animal.	0	
	tetrachlorvinphos (ear tag)	For best results apply 2 Disvap ear tags per animal.	For best results apply 2 Disvap ear tags per animal.	0	Remove tags before slaughter. Do not treat calves under 6 months.
Stable fly (apply insecticides when populations exceed 50/ animal)	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray to dampen hair on flank, brisket, legs, head and neck.	Apply as a coarse ready-to-use spray to dampen hair on flank, brisket, legs, head and neck.	0	
		OR	OR		
		Apply in a backrubber device.	Apply in a backrubber device.	0	
Face fly	crotoxyphos-dichlorvos	Apply as a coarse ready-to-use spray to dampen hair on head, neck, brisket, legs and flank.	Apply as a coarse ready-to-use spray to dampen hair on head, neck, brisket, legs and flank.	0	
	cypermethrin (ear tag)	Apply 2 ear tags/animal.	Apply 2 ear tags/animal.	0	

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Face fly cont.	fenvalerate (ear tag)	Apply 1 Bovaid ear tag on flat surface of each ear. (two tags/ animal). For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	Apply 1 Bovaid ear tag on flat surface of each ear. (two tags/ animal). For maximum benefit apply early each spring before fly activity begins. Treat entire herd.	0	Remove tags before slaughter.
	permethrin	Mix 1 L of 5% EC or 200 mL of 25% EC/ 400 L water & spray face and shoulders.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 100 gal water and spray face & shoulders.	7	
	permethrin (ear tags)	Apply 2 ear tags/animal.	Apply 2 ear tags/animal.	0	
	tetrachlor-vinphos (ear tag)	For best results apply 2 Disvap ear tags per animal.	For best results apply 2 Disvap eag tags per animal.	0	Remove tags before slaughter. Do not treat calves under 6 months.
Mosquitoes	dichlorvos	Apply as a coarse ready-to-use spray. Spray should dampen the hair on flanks, legs, brisket, head and neck.	Apply as a coarse ready-to-use spray. Spray should dampen the hair on flanks, legs, brisket, head and neck.	0	
Black flies	permethrin	Mix 1 L of 5% EC or 200 mL of 25% EC/ 400 L water & spray face and shoulders.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 100 gal water and spray face & shoulders.	7	
Horse flies	NO SATISFACTORY CONTROL METHOD AVAILABLE. DARKENED SHELTERS MAY BE PROVIDED FOR ANIMALS TO ESCAPE FLY PRESSURE.				
Cattle grub	coumaphos	Apply as a high pressure spray at a rate of 2 kg 25%WP in 100 L of water and 4.5 L of mixture per animal.	Apply as a high pressure spray at a rate of 2 lb 25%WP in 10 gal of water and 1 gal of mixture per animal.	7	Do not apply to lactating animals or more than once/season, to sick animals, or animals less than 3 months of age. Avoid application during Dec., Jan. or Feb.
	Ivermectin	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.			Follow label precautions and wait periods.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Cattle grub cont.	trichlorfon	Pour-on at the rate of 15 mL 8% Pour-on per 45 kg body weight.	Pour on at the rate of ½ fl oz 8% Pour-on per 100 lb body weight.	21	Do not treat sick animals or calves under 3 months of age. Do not use in conjunction with other organic phosphates. Avoid application in Dec., Jan. or Feb.
	fenthion	Apply Spotton with special applicator at 4 mL per 136 kg body weight. IMPORTANT: Apply on one spot on the backline of the animal.	Apply Spotton with special applicator at 4 mL per 300 lb body weight. IMPORTANT: Apply on one spot on the backline of the animal.	45	Do not apply during Dec., Jan. or Feb. Sick animals, animals under 3 months of age, or stressed animals should not be treated. Do not apply in conjunction with other organic phosphates. Avoid treatment within 10 days of shipping, weaning and dehorning.
	famphur	Apply as a ready-to-use pour-on or injectable.	Apply as a ready-to-use pour-on or injectable.	35	Follow all label restrictions.
	phosmet	Dilute 1 part phosmet in 2 parts of water. Add the water to phosmet while stirring. Apply 28 mL of fresh mixture per 45 kg body weight. Pour the mixture along the spine of the animal.	Dilute 1 part phosmet in 2 parts of water. Add the water to phosmet while stirring. Apply 1 fl oz of fresh mixture per 100 lb body weight. Pour the mixture along the spine of the animal	28	Do not use more than 225 mL (8 oz) of mixture on any animal. Calves under 3 months of age, or sick or stressed animals should not be treated.
Cattle lice	carbaryl	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP in 100 L water & spray entire animal, or use up to 0.5 kg 5% dust per animal.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water & spray entire animal or use up to 1 lb of 5% dust per animal.	-	
	crotoxyphos	Apply 15 - 30 g of 3% dust per animal for small animals and 30 - 60 g per animal for large animals. Apply dust thoroughly to all parts of the animal.	Apply 1-2 oz of 3% dust per animal for small animals and 2-4 oz per animal for large animals. Apply dust thoroughly to all parts of the animal.	0	Do not treat calves under 3 months of age.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Cattle lice cont.	fenthion	Mix 1 part 7.6% EC in 8 parts water & apply 62.5 mL/100 kg body weight along backline.	Mix 1 part 7.6% EC to 8 parts water & apply 1 fl oz/100 lb body weight along backline.	35	
	Ivermectin	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.			Follow label precautions and wait periods.
	rotenone	Apply 1% dust thoroughly to all parts of animal.	Apply 1% dust thoroughly to all parts of animal.	0	Rotenone is highly toxic to hogs if swallowed. Keep hogs away from area when dusting cattle.
	malathion	Apply as a high pressure spray at the rate of 1 L 50% malathion in 100 L water. Use 4.5 L of mixture per animal. Best time to treat is Oct. or Nov.	Apply as a high pressure spray at the rate of 16 fl oz 50% malathion in 10 gal water. Use 1 gal of mixture per animal. Best time to treat is Oct. or Nov.	7	Do not treat animals under 1 month of age or those nursing young. Avoid application to eyes, ears or nose of any animal.
		OR	OR		
		Use in a backrubber device as a 2% ready-to-use solution.	Use in a backrubber device as a 2% ready-to-use solution.	7	Do not treat animals under 1 month of age.
	permethrin	Mix 1 L of 5% EC or 200 mL of 25% EC/400 L water & spray entire animal.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/100 gal water & spray entire animal.	7	
	trichlorfon	Apply 15 mL of Pour-on per 45 kg body weight during the winter.	Apply 0.5 fl oz Pour-on per 100 lb body weight during the winter.	21	Apply only to animals treated the previous fall with a systemic for cattle grub control.
	coumaphos	Apply up to 60 g of 1% dust from a shaker can per animal.	Apply up to 2 oz of 1% dust from a shaker can per animal.	0	Do not repeat within 10 days.
American dog tick	lindane	Mix 400 g 25%WP, 500 mL 20%EC or 1 L 11%EC in 100 L water and apply up to 4.5 L of mixture/animal according to size.	Mix 6.5 oz 25%WP, 8 fl oz 20%EC or 16 fl oz 11%EC in 10 gal water and apply up to 1 gal of mixture per animal according to size.	30	One application usually sufficient for the tick season. Do not use on sick animals or animals under 3 months of age.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
HOGS					
Mange mite	lindane	Mix 20 g 25% WP, 25 mL 20% EC or 30-50 mL 10% EC in 10 L water. Apply 1.1-2.2 L per animal to point of wetting the skin. Repeat in 14 days if necessary.	Mix 3.2 oz 25% WP 4 fl oz 20% EC or 7.2 fl oz 11% EC in 10 gal water. Apply 1-2 qt per animal to point of wetting the skin. Repeat in 14 days if necessary.	30	For Veterinary use only.
	malathion	Mix 2 L 50% EC in 100 L water and apply 2.2 L per animal. Repeat in 12 days if necessary.	Mix 32 fl oz 50% EC in 10 gal water and apply 2 qt per animal. Repeat in 12 days if necessary.	0	Remove manure before spraying. Do not apply to young animals under 1 month of age or adult animals nursing young.
	coumaphos	Mix 1 kg 25% WP in 100 L water and apply as a spray. Repeat in 10 days if necessary.	Mix 1 lb 25% WP in 10 gal water and apply as a spray. Repeat in 10 days if necessary.	7	Do not apply to animals for 10 days before or after shipping, weaning vaccination or other stress. Young animals under 3 months of age or sick animals should not receive treatment.
	Ivermectin	Apply 1% injectable drug by subcutaneous injection in the neck.			Follow label precautions and wait periods.
Lice	malathion	Mix 1 L 50% EC in 100 L water and apply 2.2 L of mixture per animal as a high pressure spray. Repeat in 14 - 18 days if necessary.	Mix 16 fl oz 50% EC in 10 gal water and apply 2 qt of mixture/ animal as a high pressure spray. Repeat in 14 - 18 days if necessary.	0	Remove manure before spraying. Treat sows before farrowing. Do not treat young animals under 1 month of age or adult animals nursing young.
	coumaphos	Mix 1 kg 25% WP in 100 L water and apply 2.2 L per animal as a high pressure spray. OR Apply up to 30 g of 1% dust per animal to shoulders and back; 2 treatments 10 days apart in one season.	Mix 1 lb 25% WP in 10 gal water and apply 2 qt per animal as a high pressure spray. OR Apply up to 1 oz of 1% dust per animal to shoulders and back; 2 treatments 10 days apart in one season.	7 0	Do not apply to sick or young animals under 3 months of age or on adult animals nursing young. Avoid treatment to animals for 10 days before or after shipping, weaning, vaccination or other stress.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Lice cont.	Ivermectin	Apply 1% injectable drug by subcutaneous injection in the neck.			Follow label precautions and wait periods.
	fenthion	Use a 3% ready-to-use pour-on & pour 30 mL/100 kg body weight along backline of each animal.	Use a 3% ready-to-use pour-on & pour 1/2 fl oz/100 lb body weight along backline of each animal.	14	Do not treat sick animals or unweaned piglets of less than 30 days of age.
	lindane	Mix 25 mL 20% EC or 50 mL 10% EC/ 10 L water & apply 1 - 2 L/animal.	Mix 5 fl oz 20% EC or 10 fl oz 10% EC/ 10 gal water & apply 1 - 2 qt/animal.	30	
HORSES					
Face fly	dichlorvos	Mix 5 mL of 20%EC and 85 mL of corn syrup in 85 mL water. Place 5 mL of mixture with a brush or spray to forehead of each animal. Apply while animals are in the barn during peak fly season	Mix 1 tsp of 20%EC and 3 fl oz of corn syrup in 3 fl oz of water. Place 1/5 fl oz of mixture with a brush or spray to forehead of each animal. Apply while animals are in the barn during peak fly season.	n/a	
Horn fly	dichlorvos	Apply 28-56 mL ready-to-use per animal as a light spray once or twice daily during periods of high fly activity.	Apply 1-2 fl oz ready-to-use per animal as a light spray once or twice daily during periods of high fly activity.	n/a	
Stable fly	dichlorvos	Apply 28-56 mL ready-to-use per animal as a light spray once or twice daily during periods of high fly activity.	Apply 1-2 fl oz ready-to-use per animal as a light spray once or twice daily during periods of high fly activity.	n/a	
Lice	carbaryl	Apply ready-to-use 5% dust at 0.5 kg/ animal.	Apply ready-to-use 5% dust at 1 lb/ animal.	n/a	
	lindane	Mix 12.5 g 25%WP, 15 mL 20%EC or 30 mL 10%EC in 10 L water and apply 4.5 L of mixture per animal as a high pressure spray. Repeat after 14-18 days if necessary. Spray entire animal.	Mix 2½ fl oz 25%WP, 2½ fl oz 20%EC or 5 fl oz 10%EC in 10 gal water and apply 1 gal of mixture/animal as a high pressure spray. Repeat after 14-18 days if necessary. Spray entire animal.	n/a	Do not apply to sick or young animals under 3 months of age.
	rotenone	Apply ready-to-use dust to infested areas.	Apply ready-to-use dust to infested areas.	n/a	
Ticks	lindane	Same as for lice with exception of 1 application only.	Same as for lice with exception of 1 application only.	n/a	

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
SHEEP AND GOATS					
	coumaphos	Apply ready-to-use 1% dust to all infested parts of the body.	Apply ready-to-use 1% dust to all infested parts of the body.	0	Do not repeat treatments within 10 days.
Ked	lindane	Mix 12.5 g 25% WP, 15 mL 20% EC, or 30 mL 10% EC/10 L water and apply 1.1-2.2 L/animal once as a high pressure spray.	Mix 2½ oz 25% WP, 2½ fl oz 20% EC or 5 fl oz 10% EC/10 gal water and apply 1-2 qt/animal once as a high pressure spray.	30	Do not use on milk goats or sick animals. Do not use on animals under 3 months of age.
	rotenone	Apply 1% dust as required for control at sheering time.	Apply 1% dust as required for control at sheering time.	n/a	
Lice	lindane	Same as for ked.	Same as for ked.		
	coumaphos	Mix 1 kg 25% WP in 100 L water. Apply once as a high pressure spray.	Mix 1 lb 25% WP in 10 gal water. Apply once as a high pressure spray.	7	Do not apply to animals for 10 days before shipping, weaning, vaccination or other stress. Sick animals or those under 3 months of age should not receive treatment.
	rotenone	Apply 1% dust to point of visible cover twice, two weeks apart.	Apply 1% dust to point of visible cover twice, two weeks apart.		
Ticks	lindane	Same as for ked.	Same as for ked.		
POULTRY					
Lice	carbaryl	Apply 450 g of 5% dust per 100 birds with a hand, rotary or puff duster. Repeat in 4 weeks if necessary. Use 1.1 kg of 5% dust per box for 50 birds in dust bath boxes. OR Mix 1.1 kg 50% WP in 113 L water or 1.2 L XLR/100 L water and apply 4.5 L mixture per 100 birds as a low pressure spray. Repeat in 4-8 weeks as necessary.	Apply 1 lb of 5% dust per 100 birds with a hand, rotary or puff duster. Repeat in 4 weeks if necessary. Use 2.5 lb of 5% dust per box for 50 birds in dust bath boxes. OR Mix 2.2 lb 50% WP in 25 gal water or 1 qt XLR/21 gal water and apply 1 gal mixture per 100 birds as a low pressure spray. Repeat in 4-8 weeks as necessary.	7	Do not contaminate nests, eggs or feed and water troughs.

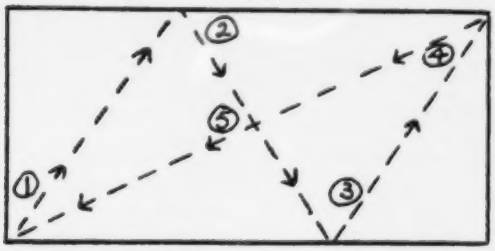
Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Restrictions
Lice cont.	coumaphos	Mix 142 g 25%WP in 31.8 L water and apply 14 mL of spray per bird as a low pressure spray. Repeat as necessary but not more than once a week.	Mix 5 oz 25%WP in 7 gal water and apply ½ fl oz of spray per bird as a low pressure spray. Repeat as necessary but not more than once a week.	1	
		on litter, mix 284 g 25%WP in 31.8 L water. Apply 5 L mixture per 100 m^2 as a high pressure spray to litter walls, ceilings. floors, roosts, nests and adjacent areas.	On litter, mix 10 oz 25%WP in 7 gal water. Apply 1 gal mixture per 1000 sq ft as a high pressure spray to litter walls, ceilings, floors, roosts, nests and adjacent areas.	n/a	Remove birds while spraying.
	malathion	Mix 1 L 50%EC in 100 L water and apply 4.5 L mixture per 100-150 birds as a low pressure spray.	Mix 8 fl oz 50%EC in 5 gal water and apply 1 gal mixture per 100-150 birds as a low pressure spray.	7	
	permethrin	Mix 1 L of 5% EC or 200 mL of 25% EC/ 100 L water & apply 4L/100 birds.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/ 25 gal water & apply 4 qt/100 birds.	7	
	tetrachlor-vinphos	Mix 1 kg 50% WP/ 100 L water. Apply 4 L/100 birds.	Mix 1 lb 50% WP/ 25 gal water. Apply 1 gal/100 birds.	0	Do not apply more than once every 14 days.
Mites	carbaryl	Same as for lice.	Same as for lice.	7	
	coumaphos	Same as for lice.	Same as for lice.	1	
	malathion	Same as for lice.	Same as for lice.	7	
	tetrachlor-vinphos	Same as for lice.	Same as for lice.	0	
Lesser meal worm	carbaryl	Mix 1.25 kg 50%WP in 100 L water. Apply as a spray to floor area in broiler houses after each batch of birds.	Mix 2½ lb 50%WP in 20 gal water. Apply as a spray to floor area in broiler houses after each batch of birds.	n/a	Do not contaminate feed or water troughs.
PETS					
Cat flea Dog flea	pyrethrin rotenone	Dust animals with pyrethrin or rotenone ready-to-use dusts thoroughly at weekly intervals or as necessary. Dust bedding and other infested areas.	Dust animals with pyrethrin or rotenone ready-to-use dusts thoroughly at weekly intervals or as necessary. Dust bedding and other infested areas.	n/a	

CROP INSECTS

Field Monitoring For Crop Insects and Damage

Before any control measures are considered, thorough field scouting should be carried out to accurately assess the kind and number of insects present and the amount of damage being done.

A variety of scouting patterns can be used.



The scouting pattern shown, using 5 sampling sites, would provide at least a minimum of information on which to make a decision. Increasing the number of sampling sites will improve accuracy of your monitoring.

The following table outlines monitoring methods and typical symptoms of damage for the most important economic crop pests in Manitoba.

Note: The economic thresholds listed in the recommendations are general guidelines only. Factors such as moisture conditions, temperature, stage of growth, etc., can increase or decrease the impact of insects on crop production.

Insect	Crop	When and How to Monitor	Typical Damage
Aphids	cereals	— July through early August — check 10 plants at each stop — record total no. of aphids and calculate average per plant	Visible wilting of plants, yellow patches in fields, plants are sticky.
	peas	— July when crop flowers — check 10, 10 cm (8") plant tips at each stop — record total no. of aphids and calculate average per plant tip	See above.
Armyworms	cereals	— mid June through July — at each stop shake plants in $1m^2$ (yd^2) area and carefully check soil surface for dislodged larvae	Leaves stripped from plants, awns chewed from heads, heads clipped.
Bertha armyworms	canola	— late July through early August — at each stop, shake plants in $1m^2$ (yd^2) area and carefully check soil surface for dislodged larvae	Outer layers of stems and pods chewed resulting in whitish appearance, holes chewed in pods.
Cutworms	cereals, canola and flax	— late May through mid July — at each stop, check several $1m^2$ (yd^2) areas. Use trowel or shovel to carefully search through top 12-25 mm (1/2-1") soil for cutworm larvae	Plants cut off at or near soil surface, some leaf feeding above ground, plants missing from rows, bare patches appearing in fields.
	corn	— at each stop, examine 100 plants in a row — calculate % of plants cut off or showing leaf feeding	See above.
	sunflowers	— at each stop, examine 100 plants in a row — calculate % of plants cut off or showing leaf feeding	See above.
Diamondback moths	canola	— July through early August — examine 10 plants at each stop and calculate average per plant	Flowers clipped or chewed, outer layers of stem and pods chewed, holes chewed in pods.

Insect	Crop	When and How to Monitor	Typical Damage
European corn borers	corn	— July when corn is over 40 cm (16") in height — at each stop, examine 10 plants for egg masses and signs of shot-holing — calculate % of plants with shot-holes	Shot-holes in leaves, holes in stalk tassels and ears.
Flea beetles	canola	— May through June when crop is in seedling stage — examine 10 plants at random at each stop — estimate overall % leaf loss	Shot-holes in leaves, complete destruction of seedling plants late May through June. Holes chewed in pods in August.
Grasshoppers	all	— May through July — check along edges of crop particularly areas adjacent to hayland and pastures — estimate no. of hoppers/m^2 (yd^2)	Black strips along margins of newly emerging crops, head clipping later in season.
Plant bugs, lygus bugs	seed alfalfa	— June through mid August — make 5 sweeps with a 38 cm (15") insect net through alfalfa canopy at each sampling site — record total no. of plant and lygus bugs (both nymphs and adults) captured — calculate average no. per sweep	Clipping of flowers and small seed pods, flowers do not develop.
Sunflower beetles	sunflowers	**Adults** — May through early June on seedling plants — examine 10 plants at random at each sampling site	Leaves of seedling plants chewed or completely destroyed late May through June, shot-holes or large areas of leaves chewed July through August.
		Larvae — July through mid August — examine 10 plants at random at each sampling site — peel back leaves around growing tip and record total no. of larvae found — calculate average no. per plant	Leaves of plants chewed or completely destroyed.
Wheat midge	wheat	— July when crop emerges from boot stage until flowering is 50% complete — check crop canopy at dusk for signs of wheat midge adult activity — examine 10 heads at each sampling site — record the no. of midge adults observed on or near heads — calculate average no. of midge per head	

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
CEREAL CROPS WHEAT, BARLEY OATS AND RYE						
Aphids	dimethoate 480	425 mL	6 fl oz	Barley prior to heading when aphid populations exceed 50/plant. All cereals after heading when populations exceed 50/head.	21	
	malathion 50 EC	1.4 L	20 fl oz		7	
Armyworms	carbaryl 80S	2.25 kg	32 oz	Spray when larval populations exceed 10/m^2 (yd^2).	14	
	malathion 50% EC	2.8 L	40 fl oz		7	
	methomyl L	1.25L	17 fl oz		20	Do not use methomyl or trichlorfon on rye.
	trichlorfon 420 Liquid	1.4 L	20 fl oz		21	
Cutworms	chlorpyrifos 4 E	875 mL-1.2 L	12-17 fl oz	When cutworms exceed 3-4/m^2 (yd^2).	60	Apply in 50-200 L water/ha (5-20 gal/ac) by ground equipment or 10-20 L/ha (1-2 gal/ac) by air.
	deltamethrin 5.0 EC	200 mL	2.8 fl oz		40	Apply in 100 L water/ha (10 gal/ac) by ground or 11-22 L/ha (1-2 gal/ac) by air.
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	For dry soil conditions use higher rate.
Grasshoppers	carbofuran 480 F	275 mL	4 fl oz	Spray when hopper populations exceed 7-12/m^2 (yd^2).	21	
	carbaryl XLR	1.2-2.5 L	17-35 fl oz		14	Use higher rate for adult hoppers.
	chlorpyrifos 4 E	580-875 mL	8-12 fl oz		60	
	deltamethrin 5.0 EC	100-150 mL	1.5-2 fl oz		40	Use higher rates as hoppers mature. Do not use at temperatures above 25 degrees C.

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
Wheat midge	carbofuran 480 F	275 mL	4 fl oz	Spray when adult midge populations exceed one per	21	
	chlorpyrifos 4 E	750 mL-1 L	11-14 fl oz	4-5 heads during period after 80% of heads have emerged from boot to end of flowering.	60	
Wireworms	Use dual purpose seed treatment containing lindane.	As directed on container label.	As directed on container label.	Apply to seed.	n/a	Use only where known wireworm problems occur. Do not feed treated seed to livestock.
CORN (field, forage)						
Armyworms	methomyl L	1.25 L	17 fl oz	When armyworm populations exceed 10/m^2 (yd^2).	3	Apply as soon as larvae appear. Repeat as necessary at 3-5 day intervals.
Cutworms	chlorpyrifos 4 E	875 mL-1.2 L	12-17 fl oz	Apply when 30% of plants are cut or 5% show leaf damage.	70	Apply in 80-200 L water/ha (10-20 gal/ac) by ground equipment or 10-20 L/ha (2-4 gal) by air.
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	For dry soil conditions use higher rate.
European corn borer	carbaryl XLR	2.5-4 L	35-60 fl oz	Spray when 50% of plants show shot-holing in leaf	1	
	carbofuran 480 F	1.1 L	16 fl oz	whorls (early July) and repeat in 7 days.	7	
Grasshoppers	carbaryl XLR	1.2-2.5 L	17-35 fl oz	Spray when hopper	1	
	carbofuran 480 F	275 mL	4 fl oz	populations exceed 7-12/m^2	7	
	malathion 50 EC	1.6 L	24 fl oz	(yd^2).	7	
Wireworms	lindane	As directed on container label.	As directed on container label.	Treat seed.	n/a	

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
	terbufos 15 G	75 g/100 m row	2.5 oz/100 yd row	At planting time.	n/a	Apply this rate for 75 cm (30 in) row spacing.
OILSEED CROPS						
FLAX						
Bertha armyworm	methomyl L	1.25 L	17 fl oz	Spray when larval populations exceed 10/m^2 (yd^2).	8	
Cutworms	chlorpyrifos 4 E	875 mL-1.2 L	12-17 fl oz	When populations exceed 10/m^2 (yd^2).	21	Apply in 80-200 L water/ha (10-20 gal/ac) by ground equipment or 10-20 L/ha (2-4 gal/ac) by air.
	deltamethrin 5.0 EC	200 mL	2.8 fl oz		40	Apply in 100-200 L water/ha (10-20 gal/ac) by ground equipment or 11-22 L/ha (2-4 gal/ac) by air.
Grasshoppers	carbofuran 480 F	275 mL	4 fl oz	When hopper populations exceed 7-12/m^2 (yd^2).	21	
	deltamethrin 5.0 EC	100-150 mL	1.5-2 fl oz		40	
	malathion 50 EC	1.6 L	24 fl oz		7	
CANOLA, MUSTARD						
Bertha armyworm, Beet webworm, clover cutworm	chlorpyrifos 4 E	750 mL-1 L	10-14 fl oz	When larval populations exceed 20-30/m^2 (yd^2).	21	Use higher rates for larger larvae or when foliage is dense.
	deltamethrin 5.0 EC	100-150 mL	1.5-2 fl oz		14	Apply in 11-22 L/ha water (2-4 gal/ac).
	methomyl L	1.25 L	17 fl oz		8	
	methamidophos 480 L	550 - 1100 mL	8-16 fl oz		10	

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
Cutworms	chlorpyrifos 4 E	875mL-1.2 L	12-17 fl oz	When numbers exceed 3-4/m^2 (yd^2).	21	Apply in 80-200 L water/ha (10-20 gal/ac) by ground equipment or 10-20 L/ha (2-4 gal/ac) by air.
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	For dry soil conditions use higher rate.
Diamondback moth	azinphos-methyl SC	1.4 L	20 fl oz	When numbers exceed 30/10cm^2 (30/ft^2).	30	
	deltamethrin 5.0 EC	100-150 mL	1.5-2 fl oz		14	Apply in 11-22 L/ha (2-4 gal/ac) by air.
	malathion 50 EC	700 mL	10 fl oz		7	
	trichlorfon 420 Liquid	2.8 L	40 fl oz		11	Use trichlorfon during late evening if honeybees are foraging.
Flea beetles: *At Seeding*	carbofuran CR-10	2.8 kg	2.5 lb	Mix with seed. Use drill seeder only.	n/a	Do not handle with bare hands, wear rubber or PVC gloves. For lindane do not use feed or feed mixing equipment to mix seed treatments or dressings.
	lindane seed treatment	As directed on container label.	As directed on container label.	Treat seed	n/a	
	terbufos 5 G	5.5-11.0 kg	5-10 lb	Mix with seed. Use drill seeder only.	n/a	
Foliage Sprays	carbaryl XLR	0.5 L	7 fl oz	Apply post-emergence sprays when 25% of the leaf surface of seedling plants is destroyed by beetles.		Do not use carbaryl or carbofuran after pod formation.
	carbofuran 480 F	140-280 mL	2-4 fl oz			Do not apply more than 280 mL carbofuran per ha per season.
	cypermethrin 250 EC	140 mL	2 fl oz		30	Ground application only. Do not apply at temperatures above 27 degrees C.

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
	deltamethrin 5.0 EC	100-150 mL	1.5-2 fl oz		14	Do not apply at temperatures above 25 degrees C.
	malathion 50 EC	1.1 L	16 fl oz		7	
Grasshoppers	carbofuran 480 F	280 mL	4 fl oz		60	
	chlorpyrifos 4E	580-875 mL	8-12 fl oz		21	
	malathion 50 EC	1.6 L	24 fl oz		7	
Red turnip beetle	azinphos-methyl SC	550-800 mL	8-12 fl oz	Spray field margins when infestations occur.	30	
	carbofuran 480 F	280 mL	4 fl oz		60	
SUNFLOWERS						
Cutworms	chlorpyrifos 4 E	875 mL-1.2 L	12-17 fl oz	When stand reduction exceeds 25-30%.	90	Apply in 80-200 L water/ha (10-20 gal/ac) by ground equipment or 10-20 L/ha (2-4 gal/ac) by air.
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	For dry soil conditions use higher rate.
Sunflower beetle	carbofuran 480 F	140-280 mL	2-4 fl oz	Spray when adult beetle populations exceed 1 per 2 seedling plants or when larval populations exceed 10-15/plant.	60	Use higher rate for adult beetles.
	cyper-methrin 250 EC	100 mL	1.5 fl oz		70	Ground application only. Apply in 100-120 L/ha (10-20 gal/ac) water.
	deltamethrin 5.0 EC	100 mL	1.5 fl oz		70	Apply in 100-200 L water/ha (10-20 gal/ac) by ground or 11-22 L/ha (2-4 gal/ac) by air.
Thistle caterpillar	azinphos-methyl SC	1.1 L	16 fl oz			Do not apply after heads begin to form.

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
FORAGE CROPS						
ALFALFA (SEED)						
Plant bugs, Lygus bugs	dimethoate 480 EC	1.2 L	17 fl oz	Apply just before alfalfa begins to bloom. A second application may be required later in the season if plant bug numbers exceed 5/sweep. Use trichlorfon on crops in bloom.	28	Do not put leafcutter bees on crop within 7 days of spraying with dimethoate or methadathion or within 1 day with deltamethrin.
	deltamethrin 5.0 EC	200 mL	3 fl oz			
	methida-thion 25 EC	1.1-2.2 L	16-32 fl oz		10	
	trichlorfon 420 Liquid	1.4 L	20 fl oz		14	Apply in late evening when bees are not foraging.
SWEET CLOVER						
Sweet clover weevil	azinphos-methyl SC	2.25 L	32 fl oz	Apply to seedling crops when weevil damage is first noticed.		Second year crops rarely need protection.
	carbaryl XLR	2.5 L	40 fl oz			
ALFALFA, CLOVER, GRASSES						
Grasshoppers	carbaryl XLR	1.2-3.5 L	17-49 fl oz	Spray when hopper populations exceed 13-25/m^2 (yd^2).	0	
	carbofuran 480 F	275 mL	4 fl oz		1	
	malathion 50 EC	1.6 L	24 fl oz		7	
PASTURES						
Grasshoppers	carbaryl XLR	1.2-3.5 L	17-49 fl oz		0	May be grazed on day of application.
	carbofuran 480 F	275 mL	4 fl oz	Spray when hopper populations exceed 13-25/m^2 (yd^2).	1	
	malathion 50 EC	1.6 L	24 fl oz		0	May be grazed on day of application.

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
SPECIAL CROPS						
SUGAR BEETS						
Beet webworm	trichlorfon 420 Liquid	2.8 L	40 fl oz	Spray early to late June when leaf damage occurs.	28	
Cutworms	chlorpyrifos 4 E	1.2-2.4 L	17-34 fl oz	Spray seedling crops when damage occurs.	90	Apply in 50-200 L water/ha (5-20 gal/ac).
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	Ground application only. For dry soil conditions use higher rate.
Sugarbeet root maggot	aldicarb 10 G	11 kg	9.8 lb			
	carbofuran 10 G	8.25 kg	7.5 lb	Apply to drill row at seeding.		
	terbufos 15 G	7.3 kg	6.5 lb			Do not apply terbufos in direct contact with seed.
FABA BEANS						
Aphids	dimethoate 480 EC	425 mL	6 fl oz	Spray when 75% of the plants have 1 or more aphids.	7	
	malathion 50 EC	2 L	28 fl oz			
Blister beetles	carbaryl XLR	2.5-4 L	35-56 fl oz	Spray field margins when infestations occur.	14	
FIELD PEAS						
Aphids	dimethoate 480 EC	425 mL	6 fl oz	Spray when an average of 2-3 aphids per 20 cm (8 in) plant tip are present at flowering.	3	
	malathion 50 EC	1.4 L	20 fl oz		3	

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest. Feeding	Restrictions
VEGETABLE INSECTS - COMMERCIAL						
ALL VEGETABLES						
Cutworms	chlor-pyriphos 4E	1.4-2.8 L	20-40 fl oz	Apply along rows immediately when damage is seen.	Variable	Carefully observe waiting periods listed on container label for each crop.
	permethrin (Ambush 500 EC)	140-300 mL	2-4 fl oz		1	Ground application only. For dry soil conditions use higher rate.
BEETS						
Leafminers	malathion 500 EC	1.75 L	25 fl oz	Spray when egg masses are noticed on underside of leaves.	7	For bunching beets only.
Tarnished plant bug	dimethoate 480 EC	700 mL	10 fl oz		12	
CABBAGE, CAULIFLOWER, BRUSSELS SPROUTS, BROCCOLI						
Aphids	dimethoate 480 EC	550-1000 mL	8-14 fl oz		4 (21 for brussels sprouts)	
	malathion 500 EC	1.1 - 2.8 L	16-40 fl oz		7 (3 for broccoli)	
	methamido-phos 480 L	1.2-2.3 L	16-33 fl oz		7-cabbage, cauliflower 14-broccoli brussels sprouts.	
Cabbage worms, loopers, diamondback moth	Bacillus thuringien-sis	Follow label			0	
	deltame-thrin 5 EC	150-200 mL	2-2.8 fl oz		7	Use in 350-550 L of water per ha (30-50 gal/ac).
	diazinon 50E	1.1 L	16 fl oz		7	
	endosulfan 4E	1.4-2.1 L	20-30 fl oz		7	
	fenvalerate EC	150-325 mL	2.3-4.7 fl oz		14	
	metha-midophos 480 L	1.2-2.3 L	16-33 fl oz		7-cabbage, cauliflower 14-broccoli, brussels sprouts.	
	methomyl L	1.25-2.5 L	17-33 fl oz		7 (1 for cabbage)	
	permethrin (Ambush 500 EC)	70-140 mL	1-2 fl oz		3 (7 for broccoli).	

Note: kg/ha X 0.4047 = kg/ac

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
Flea beetles	carbaryl XLR	1.25-2.5 L	18-36 fl oz		3	
	endosulfan 4E	1.4-3.0 mL	20-40 fl oz		7	
Root maggots	chlorfen-vinphos 10G	1750 g/ 1000 m row	20 oz/1000 ft of row	Work granules into top 2.5 cm (1") of soil in 15 cm (6") band. Seed into band.		
	fensulfo-thion 15G	1250 g/ 1000 m row	13.3 oz/ 1000 ft of row	Apply granules at time of seeding.		
Slugs	metaldehyde					Do not apply directly to plants. Use baits or liquid slug killers according to label directions.
CARROTS						
Leafhoppers	carbofuran 10G	22.5 kg	20 lb	For prevention of aster yellows, apply at time of seeding.		
	carbaryl XLR	1.25-2.5 L	18-36 fl oz	When infestations remain high after late July, spray twice weekly with malathion or carbaryl.	1	Use lower rate of carbaryl on young plants.
	malathion 500 EC	1-3 L	14-42 fl oz		7	
CELERY						
Aphids	malathion 500 EC	2.0 L	28 fl oz		3	
Leafhoppers	malathion 500 EC	2.0 L	28 fl oz	Spray twice weekly from time of emergence.		
Slugs	metaldehyde			Spray between rows (not on plants) in early June. Repeat as required or apply metaldehyde baits between rows.		
CORN (Sweet)						
European corn borer	carbaryl XLR	2.5-4.0 L	35-56 fl oz	Apply two or more sprays when 15% or more plants show leaf feeding in the whorls (early July).	1	
	carbofuran 480 F	1.1 L	16 fl oz		7	
	methomyl L	2.60 L	37 fl oz		3	

Note: L/ha X 0.4047 = L/ac

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
European corn borer	permethrin (Ambush) 500 EC	200-275 mL	2.9-3.9 fl oz	Apply two or more sprays when 15% or more plants show leaf feeding in the whorls (early July).	1	
CUCUMBERS						
Cucumber beetle	azinphos-methyl SC	2.25 L	31.5 fl oz		6	
	endosulfan 4E	1.5 L	20 fl oz		2	
Aphids	malathion 500 EC	2.0 L	28 fl oz		3	
EGGPLANT						
Aphids.	malathion 500 EC	1.1-2.8 L	16-40 fl oz		3	
Colorado potato beetle	carbaryl XLR	1.25 L	18 fl oz		1	
Flea beetle	endosulfan 4E	1.4 L	20 fl oz		2	
ONIONS						
Onion maggot (furrow treatment) (table onions)	diazinon 5G	34 kg	30 lb	Apply granules to rows spaced at 40 cm with positive feed Gandy-type applicator in furrow with the seed.		
	fensulfo-thion 15 G	7.5 kg	6.6 lb			
	fonofos 10 G	11 kg	9.7 lb.			For organic soils only (more than 10% organic matter).
Onion maggot flies	diazinon 500 EC	1.1 L	16 fl oz	Spray when flies appear after seed-lings emerge and during July.	10	
POTATOES	dimethoate 480 EC	580-1400 mL/ha	8-20 fl oz	Spray when aphid numbers exceed 30/100 leaves.	7	
Aphids	fenvalerate 30 E	230-330 mL	3-4 fl oz		7	
	malathion 500 EC	1.25 L	18 fl oz		7	
	methamido-phos 480 L	1.75-2.25 L	25-31 fl oz		14	
Colorado potato beetle	azinphos-methyl SC	1.25-1.75 L	17-25 fl oz	Spray when leaf damage exceeds 10%.	7	
	carbaryl XLR	1.25 L	18 fl oz		7	
	carbofuran 480 F	1.1 L	16 fl oz		7	
	deltamethrin 5.0 EC	100-150 mL	1.4-2.1 fl oz	Use in 200-500 L of water per ha (18-44 gal/ac).	23	Aircraft application allowed only twice a season.
	phorate 15G	15-21 kg	13-19 lb	Apply at seeding.		

Note: kg/ha X 0.4047 = kg/ac

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
Colorado potato beetle	fenvalerate 30 EC	100-150 mL	1.4-2.3 fl oz		7	
	methamidophos 480 L	1.75-2.25 L	21-32 fl oz		14	
	permethrin (Ambush) 500 E	140-200 mL	2-2.8 fl oz		1	
Potato leafhopper	carbaryl XLR	1.25 L	18 fl oz	Spray when leafhopper numbers exceed 30/100 leaves.	7	
	fenvalerate 30 EC	100-315 mL	1.5-4.5 fl oz		7	
	malathion 500 EC	1.8 L	24 fl oz		3	
	permethrin (Ambush) 500 E	140-200 mL	2-2.8 fl oz		1	
RADISH						
Flea beetles	carbaryl XLR	1.25-2.5 L	18-36 fl oz		7	
	diazinon 500 EC	1.1 L	16 fl oz		10	
	malathion 500 EC	1.1-2.8 L	16-40 fl oz		7	
Radish maggot	diazinon 5G	1.8 kg/1000 m row	20 oz/1000 ft of row	Apply granules in furrow when planting.		
RUTABAGA, TURNIP						
Flea beetles	diazinon 500 EC	1.1 L	16 fl oz		14	
	endosulfan 4E	2.1 L	30 fl oz		45	
	malathion 500 EC	1.1 - 2.8 L	16-40 fl oz		7	

Note: L/ha X 0.4047 = L/ac

Crop and Pest	Insecticide And Most Common Formulation	Amount of Product Per hectare	Amount of Product Per Acre	Where and When to Apply	Minimum Days to Harvest, Feeding	Restrictions
Root maggots BAND TREATMENT	carbofuran 10G	1.75 kg/ 1000 m row	20 oz/1000 ft row	Work granules into top 2 cm of soil in 15 cm band, seed down center; or apply with a Gandy applicator by placing delivery fan in front of the seed coulter. The granules are applied and incorporated by the bow wave action of the seeder.		
	chlorfenvin-phos 10G	1.75 kg/ 1000 m row	20 oz/1000 ft row			
	fensulfo-thion 15G	1.15 kg/ 1000 m row	12 oz/1000 ft row			
	diazinon 5G	1.8 kg/ 1000 m row	20 oz/1000 ft row			
DRENCH TREATMENT	carbofuran 480 F	5.25 L	74 fl oz	Apply as coarse spray in 10 cm band over the row using single nozzle. Apply at 1100-1700 L/ha.	40	70 cm row spacing
	fensulfo-thion 7.2 EC	3.1 L	44 fl oz		40	
	chlorfenvin-phos 40EC	5.6 L	80 fl oz		40	
	diazinon 500 EC	2.8 L	39 fl oz		14	
TOMATO						
Flea beetles	endosulfan 4E	1.4 L	20 fl oz		2	
	malathion 50EC	1.1 L	16 fl oz			
Variegated cutworm	carbaryl XLR	125 mL/ 300 m of row	1.5 fl oz/ 300 ft. of row	Use at least 225-275 L of water per hectare (20-25 gal/ ac). Spray in a 25-30 cm (10-12 in) band over the row.	1	

Note: kg/ha X 0.4047 = kg/ac

VEGETABLE INSECTS — HOME GARDEN

Pest	Insecticide	Metric	Imperial Measure	Remarks
Aphids	diazinon 12.5% EC	8 mL/L	8 tsp/gal	
	dimethoate 2 E	2 mL/L	2 tsp/gal	
	malathion 50% EC	2 mL/L	2 tsp/gal	
Colorado Potato Beetle, Flea Beetles	carbaryl 50 WP	4 mL/L	4 tsp/gal	
	diazinon 12.5% EC	8 mL/L	8 tsp/gal	
	malathion 50% EC	8 mL/L	8 tsp/gal	
	methoxychlor 25 EC	10 mL/L	10 tsp/gal	
	rotenone D			Dust plants as required.
Imported Cabbage worm, Cabbage looper, Diamondback moth	diazinon 12.5% EC	8 mL/L	8 tsp/gal	
	malathion 50% EC	4 mL/L	4 tsp/gal	
	rotenone D			Dust plants thoroughly.
Cutworms	chlorpyrifos 0.5 G			Use according to label directions.
	chlorpyrifos 10 EC			Use according to label directions.
	diazinon 5 G			Use according to label directions.
European corn borer, Corn earworm	carbaryl 50% SP	6-10 g/L	6-10 tsp/gal	Spray at weekly intervals from early July to mid-August.
	malathion 50% EC	3 mL/L	3 tsp/gal	
Turnip, Cabbage, Radish maggots	diazinon 5% G			Apply granules according to label prior to planting.
	diazinon 12.5% EC	8 mL/L	8 tsp/gal	Apply as a drench to rows.
Slugs	metaldehyde			Use prepared slug baits.

FRUIT INSECTS

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days From Last Application To Harvest	Remarks
APPLE, PLUM OTHER FRUIT TREES					
Tent caterpillar	malathion 50%EC	Mix 1-2 mL in 1 L water. Spray when larvae are seen or damage is noticed.	Mix 1-2 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	3	
	methoxy-chlor 50%WP	Mix 2 g in 1 L water. Spray when larvae are seen or damaged is noticed.	Mix 2 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	7	
	carbaryl 50%WP	Mix 2-4 g in 1 L water. Spray when larvae are seen or damaged is noticed.	Mix 5 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	7	
Apple seed chalcid	methoxy-chlor 50%WP	Mix 2 g in 1 L water and spray about June 18. Repeat 1 week later.	Mix 2-4 tsp. in 1 gal water and spray about June 18. Repeat 1 week later.	7	
Aphids	diazinon 12½%EC	Mix 6 mL in 1 L water and spray as foliar spray. Repeat as necessary.	Mix 2 tbsp in 1 gal water and spray as foliar spray. Repeat as necessary.	14	
	dimethoate 2E	Mix 2 mL in 1 L water. Apply as foliar spray. Repeat as necessary.	Mix 2 tsp in 1 gal water. Apply as foliar spray. Repeat as necessary.	7	
	malathion 50%EC	Mix 2 mL in 1 L water and apply as a foliar spray. Repeat as needed.	Mix 2 tsp/gal water and apply as a foliar spray. Repeat as needed.	3	
Scale	diazinon 12½%EC	Mix 2 mL in 1 L water. Apply as a spray to trunk and branch where scales are found.	Mix 2 tsp in 1 gal water. Apply as a spray to trunk and branch where scales are found.	14	
	carbaryl 50%WP	Mix 2-4 g in 1 L water; apply to infested areas.	Mix 2-4 tsp in 1 gal water; apply to infested areas.	7	
	malathion 50%EC	Mix 2 mL in 1 L water and apply to infested areas.	Mix 2 tsp in 1 gal water and apply to infested areas.	3	
Fall cankerworm	carbaryl 50% WP	Mix 6 g in 1 L water. Spray in early spring when larvae are seen or damage is noticed.	Mix 1 oz/gal water. Spray in early spring when larvae are seen or damage is noticed.	n/a	

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days From Last Application To Harvest	Remarks
Fall cankerworm cont.	methoxychlor 50% WP	Mix 2 g in 1 L water & spray in early spring when larvae are seen or damage is noticed.	Mix 1/3 oz/gal water & spray in early spring when larvae are seen or damage is noticed.	n/a	
	Tree tanglefoot	Ready-to-use. Apply to tree trunks in late Sept. immediately after first heavy frost.	Ready-to-use. Apply to tree trunks in late Sept. immediately after first heavy frost.		
Plum curculio	methoxy-chlor 50%WP	Mix 3 g in 1 L water. Apply as a spray when fruit is just beginning to form. Repeat application 10 days later.	Mix 3 tsp in 1 gal water. Apply as a spray when fruit is just beginning to form. Repeat application 10 days later.	7	
Apple maggot	carbaryl 50% WP	Mix 8 g in 1 L water and apply after petal drop and again 10 days later.	Mix 4 tbsp in 1 gal water and apply after petal drop and again 10 days later.	7	
CURRANT, GOOSE BERRY					
Currant fruit fly	methoxy-chlor 50%WP	Mix 2 g in 1 L water and apply as spray when 80% of the fruit has set. Repeat application 10 days later.	Mix 2 tsp in 1 gal water and apply as spray when 80% of the fruit has set. Repeat application 10 days later.	14	
Imported currant worm	diazinon 12½%EC	Mix 4 mL in 1 L water and apply as spray immediately when larvae are seen.	Mix 4 tsp in 1 gal water and apply as spray immediately when larvae are seen.		Do not spray during or after bloom.
	rotenone 1%D	Apply to plants after fruit is set.	Apply to plants after fruit is set.		
Aphids	malathion 50%EC	Mix 1.5 mL in 1 L water and use as spray when aphids appear. Repeat as needed.	Mix 1¼ tsp in 1 gal water and use as spray when aphids appear. Repeat as needed.	3	
RASPBERRY					
Raspberry fruitworm	rotenone 40% WP	Mix 5 g in 1 L water. Apply when berries start to form.	Mix 5 tbsp in 1 gal water. Apply when berries start to form.		
Spider mites	dicofol 18½%EC	Mix 4 mL in 1 L water. Apply when necessary and repeat as required.	Mix 2 tbsp in 1 gal water. Apply when necessary and repeat as required.	2	

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days From Last Application To Harvest	Remarks
COMMERCIAL APPLICATION STRAWBERRY					
Tarnished plant bug	dimethoate 240 EC	Mix 2.5 L in sufficient water/ha.	Mix 50 fl oz in sufficient water/ac.		Apply when population levels are 1 or more nymphs/25 blossom clusters.
	endosulfan 50%WP	Mix 2.2 kg in sufficient water/ha.	Mix 2 lb in sufficient water/ac.	7	
Strawberry cutworm	chlorpyrifos 4E	Apply 1.2 L in 2000 L water/ha between June 1-15.	Apply 20 fl oz in 200 gal water/ac. between June 1-15.	20	
Leaf rollers	azinphos-methyl 50% WP	Mix 1.1 kg in 1600 L of water/ha. Apply when insects first appear.	Mix 1 lb in 140 gal of water/ac. Apply when insects first appear.	5	
	diazinon 50%EC	Mix 1 L in 1000 L of water and apply mixture at 2000 L/ha. Apply when insects first appear.	Mix 14 fl oz in 200 gal of water and apply mixture at 400 gal/ac. Apply when insects first appear.	5	
	malathion 50%EC	Mix 1.5 L in sufficient water/ha. Apply when insects first appear.	Mix 1 pint in sufficient water/ac. Apply when insects first appear.	3	
Cyclamen mites	dicofol 18½%WP	Mix 2.2 kg in sufficient water/ha and apply at pressure of 675-1375 kPa. Repeat needed.	Mix 2 lb in sufficient water/ac and apply at pressure of 100-200 psi. Repeat as needed.	7	

COMMERCIAL GREENHOUSE INSECTS

NOTE: WEAR SPECIAL PROTECTIVE EQUIPMENT WHEN USING FUMIGANTS OR SMOKES AND VENTILATE THOROUGHLY AFTER EXPOSURE PERIOD.

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
ORNAMENTAL PLANTS				
Aphids	aldicarb 10 G	600-1250 g/100 m^2	20-40 oz/1000 sq ft	Extremely toxic. Follow label safety instructions closely. Chrysanthemum and Poinsettia only. Do not use plant parts for food or feed. Do not market potted plants within 4 weeks of last application. Do not plant food crops in treated soil for at least 1 year after treatment. Do not work treated area within 48 hours of application.
	soap	1 part soap/40 parts water	1 part soap/40 parts water	
	diazinon 500 EC	1-1.5 L/1000 L water	16-24 fl oz/100 gal water	
	dichlorvos	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	lindane	1 pellet/200 m^3	1 pellet/7,000 cu ft	
	nicotine sulfate	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	malathion 50EC	2 L/1,000 L water	32 fl oz/100 gal water	
	pirimicarb 50 WP	500 g/1,000 L water	7 oz/100 gal water	
Greenhouse whitefly	aldicarb 10 G	600-1250/100 m^2	20-40 oz/1000 sq ft	Extremely toxic. Follow label instructions carefully. Chrysanthemum and Poinsettia only. Do not use plant parts for food or feed. Do not market potted plants within 4 weeks of last application. Do not plant food crops in treated soil for at least 1 year after treatment. Do not work treated area within 48 hours of application.
	soap	1 part soap/40 parts water	1 part soap/40 parts water	
	dichlorvos	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	lindane	1 pellet/200 m^3	1 pellet/7,000 cu ft	
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
Greenhouse whitefly cont.	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	permethrin 50 EC	125-200 mL/1000 L water	2-3.2 fl oz/100 gal water	
	malathion 50 EC	2.5 L/1,000 L water	32 fl oz/100 gal water	
	chlorpyrifos 25 WP	960 g/1,000 L water	18 oz/100 gal water	
Mealybugs	dichlorvos	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	soap	1 part soap/40 parts water	1 part soap/40 parts water	
	malathion 50 EC	2.5 L/1,000 L water	32 fl oz/100 gal water	
	chlorpyrifos 25 WP	3.9 kg/1,000 L water	18 oz/100 gal water	
Thrips	diazinon 500 EC	1-1.5 L/1000 L water	16-24 fl oz/100 gal water	
	dichlorvos	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	lindane	1 pellet/200 m^3	1 pellet/7,000 cu ft	
	nicotine sulfate	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	chlorpyrifos 25 WP	960 g/1,000 L water	18 oz/100 gal water	
	deltamethrin 5 EC	350-500 mL/1,000 L water	3.5-7 fl oz/100 gal water	Do not apply within 7 days of harvest. Do not use with fogging machines.
Spider Mite	aldicarb 10 G	600-1250 g/100 m^2	20-40 oz/1000 sq ft	Extremely toxic. Follow label instructions closely. Chrysanthemum and Poinsettia only. Do not use plant parts for food or feed. Do not market potted plants within 4 weeks of last application. Do not plant food crops in treated soil for at least 1 year after treatment. Do not work treated area within 48 hours of application.
	dichlorvos	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	dicofol 18.5 E	1.2 L/1000 L water	20 fl oz/100 gal water	

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
Spider Mite cont.	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	tetradifon	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	
	dienochlor 50 WP	620 g/1000 L water as a spray	10 oz/100 gal water as a spray	
	fenbutatin-oxide 50 W	500 g - 1 kg/1000 L water as a spray	8-16 oz/100 gal water as a spray	
	Soap	1 part soap/40 parts water	1 part soap/40 parts water	

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
HOME GROUNDS					
BIRCH					
Bronze birch borer	Cultural control is to maintain birch trees in healthy condition through watering and general tree maintenance.				
SPRUCE TREES					
Spruce budworm	Bacillus thuringiensis			Use according to label instructions.	
	dimethoate 240E	4 mL/L of water	⅔ fl oz/ gal of water	Spray foliage thoroughly in early June before buds are damaged.	With all chemical insecticides, more than one application will usually be required.
	malathion 50EC	2 mL/L of water	⅓ fl oz/ gal of water		
	trichlorfon 420 Liquid			Use according to label instructions.	
Pine needle scale (attacks pine & spruce)	dimethoate 240E	4 mL/L of water	⅔ fl oz/ gal of water	Spray till foliage drips. One treatment in mid-June & one in August.	
	malathion 50EC	2 mL/L of water	⅓ fl oz/ gal of water		
	diazinon 12½EC	2 mL/L of water	⅓ fl oz/ gal of water		
Spruce spider mite	dicofol 18.5EC	2 mL/L of water	⅓ fl oz/ gal of water	Spray foliage until wet.	One treatment during the third week in May followed by another in late June or early July.
	malathion 50EC	4 mL/L of water	⅔ fl oz/ gal of water		
TREES AND SHRUBS					
Aphids	diazinon 12½EC	6 mL/L of water	1 fl oz/ gal of water	Spray foliage thoroughly as required.	
	dimethoate 240EC	2 mL/L of water	⅓ fl oz/ gal of water		Do not use dimethoate on American Elm.
	malathion 50EC	2 mL/L of water	⅓ fl oz/ gal of water		
Ash plant bug	carbaryl 50WP	2 g/L of water	⅓ oz/gal of water	Apply when plant bugs are seen or stipling effect is observed on leaves.	
	diazinon 12½EC	2 mL/L of water	⅓ fl oz/ gal of water		
Cankerworm	Bacillus thuringiensis			Apply according to label instructions.	
	carbaryl 50WP	6 g/L of water	1 oz/gal of water		
	malathion 50/EC	2 mL/ L of water	⅓ fl oz/ gal water	Spray foliage when damage appears in spring.	
	methoxychlor 50WP	2 g/L of water	⅓ oz/gal of water		

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
Cankerworm	tree tangle-foot	Ready-to-use	Ready-to-use	Apply to tree trunks in late September immediately after first heavy frost.	
Pear slug	carbaryl 50 WP	2 g/L of water	⅓ oz/gal of water	Spraying is usually required in late June and early July.	
	malathion 50EC	2 mL/L of water	⅓ fl oz/gal of water		
	rotenone	Ready-to-use	Ready-to-use		
Leafminers	diazinon 12½EC	2 mL/L of water	⅓ fl oz/gal of water		Two applications are necessary for full season control, one in spring and one about the end of July.
	carbaryl 50WP	2 g/L of water	1/3 oz/gal of water		
	dimethoate 240EC	2 mL/L of water	⅓ fl oz/gal of water		
	malathion 50EC	2 mL/L of water	⅓ fl oz/gal of water		
Sawflies	malathion 50EC	2 mL/L of water	⅓ fl oz/gal of water	Spray foliage when insects and damage become evident.	
Gall insects					Effective control is not available. Damage usually does not effect tree health. Remove and burn galls if possible.
ELM					
Elm bark beetle	chlorpyrifos	0.5% solution	0.5% solution		
	methoxychlor	4-12% solution	4-12% solution	Apply between August 14 and September 5. Thoroughly wet lower 2.5 m (8 ft) of tree to base of root flare.	
Spiny elm caterpillar	malathion 50EC	2 mL/L of water	⅓ fl oz/gal of water		Caterpillars are generally localized in one part of the tree. Spray where needed.

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
COMMERCIAL APPLICATION					Do not apply with aircraft at wind speeds in excess of 12 km/hr.
CONIFERS					
Spruce budworm	dimethoate 480 EC	1.1 L in at least 10 L of water/ha	24 fl oz in at least 1 gal of water/ac	Aerial Application	Apply spray when the bulk of the larvae are in 3rd and 4th instars.
		1.5 L/1000 L of water	20 fl oz/100 gal of water	Hydraulic Ground Applicator	More than one application may be required to achieve adequate control.
	malathion 500 EC	1.5 L in at least 10 L water/ha	20 fl oz in at least 1 gal of water/ac.	Aerial Application	
		1 L in 1000 L of water	16 fl oz in 100 gal of water	Hydraulic Ground Applicator	
	trichlorfon 420 Liquid	2.8-3.5 L in at least 22 L water/ha	2-2 7/8 pts in at least 2 gal water/ac	Aerial Application	May cause spotting of automobile paint surfaces.
		2.8-3.5 L in 1400 L of water/ha	2-2 7/8 pts in at least 125 gal water/ac.	Hydraulic Ground Applicator	
DECIDUOUS TREES					
Cankerworm	malathion 500 EC	1.5 L in at least 10 L water/ha	20 fl oz in at least 1 gal of water/ac.	Aerial Application	
		1.5 L in 1000 L water	20 fl oz in 100 gal water	Hydraulic Ground Applicator	
	methoxychlor 50WP	2 kg in 1,000 L water	16 oz in 100 gal water	Hydraulic Ground	
Scale Insects	carbaryl 50WP	55-70 g/45 L water	2-2.5 oz/10 gal water	Hydraulic Ground Applicator	Apply chemicals during crawler stage approximately mid-June.
	diazinon 12½EC	225 mL/450 L water	8 fl oz/100 gal water	Hydraulic Ground Applicator	
	dimethoate 480 EC	110 mL/450 L water	4 fl oz/100 gal water	Hydraulic Ground Applicator	
	malathion 500 EC	225 mL/450 L water	8 fl oz/100 gal water	Hydraulic Ground Applicator	

TURF INSECTS

Crop and Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Application	Remarks
Ants	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/ 1000 ft^2	Water into soil after application	
	diazinon 12½ %EC	300-600 mL/100 m^2	10-20 fl oz/ 1000 ft^2	Apply in 10-20 gal (50-90 L) of water	Mow lawn before treatment. Water thoroughly after treatment.
Chinch bug	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/ 1000 ft^2		
Earthworms Dew worms					
	carbaryl 50%WP	250 g/ 100 m^2	16 oz/ 1000 ft^2	Apply in 90 L (20 gal) of water	
Glassy cutworm	chlorpyrifos 2E	45 mL/100 m^2 100 m^2	1.5 fl oz/ 1000 ft^2		
	diazinon 12½ %EC	250 mL/5 L water/ 100 m^2	8 fl oz/gal water/ 1000 ft^2		Water thoroughly after treatment.
Sod webworm	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/ 1000 ft^2		
	diazinon 12½ %EC	300-600 mL/5 L water/ 100 m^2	10-20 fl oz/ gal water/ 1000 ft^2		Water thoroughly after treatment.
White grub	chlorpyrifos 2E	90 mL/100 m^2	3 fl oz/ 1000 ft^2		
	diazinon 12½ %EC	600 mL/5 L water/ 100 m^2	20 fl oz/gal water/ 1000 ft^2		Water thoroughly after treatment. Apply between July and early October.

HOUSEHOLD INSECTS

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where to Apply	Remarks and Precautions
Ants	diazinon 12½%EC	50 mL in L water	1 fl oz in 1 pint water	Spray around doorsteps and lower windows to prevent entry to home. Indoors, spray around sinks, baseboards and other areas where ants are found.	Do not treat countertops or other surfaces coming in direct contact with food.
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol		
	chlorpyrifos	0.5% ready-to-use solution	0.5% ready-to-use solution		
	resmethrin	Ready-to-use Aerosol	Ready-to-use Aerosol		
Bedbugs	malathion (premium grade) 83.6%	8 mL in L water on mattresses and upholstery; 20 ml elsewhere	1 tsp in 1 pint water on mattresses and upholstery	Spray bed springs and frames, cracks and crevices in wall where bedbugs hide. Mattresses, particularly tufts and folds should be lightly sprayed.	Use only premium grade deodorized malathion.
Black carpet beetle	diazinon 12½EC	50 mL in L water	1 fl oz in pint water	Spray cracks and crevices around baseboards or where larvae are noticed.	Vacuuming of baseboards and other places eliminates carpet beetles. Protect stored woolens and other material fabrics with moth flakes.
	chlorpyrifos	0.5% ready-to-use solution	0.5% ready-to-use solution		
	malathion (premium grade) 83.6%EC	50 mL in L water	1 fl oz in 1 pint water		
	propoxur	1% ready-to-use aerosol	1%ready-to-use aerosol		
Clothes moths	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol	Spray infested storage areas.	Protect woolens and other natural fabrics with moth flakes.
Clover mites	diazinon 12½%EC	8 mL/L water	1 fl oz/gal water	Spray diazinon, dicofol or malathion on grass around foundation to prevent migration of mites from grass into home.	Apply at rate of 5 L spray mixture/10 m of lawn area (1 gal/100 ft^2).
	dicofol 18.5%EC	8 mL/L water	1 fl oz/gal water		
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol	Spray indoors around windows and doors to prevent entry of mites.	
Cockroaches	chlorpyrifos	0.5% ready-to-use solution	0.5% ready-to-use solution		

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where to Apply	Remarks and Precautions
Cockroaches	diazinon	50 mL/L water	1 fl oz/pint water	Apply to areas where cockroaches are commonly seen.	Avoid contamination of food or utensils.
	permethrin	0.5% ready-to-use aerosol	0.5% ready-to-use aerosol		
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol		
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
Crickets	chlorpyrifos	0.5% ready-to-use aerosol	0.5% ready-to-use aerosol		
	diazinon 12½ %EC	50 mL/L water	1 fl oz/pint water	Spray area around house particularly near entrance.	
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol	Apply indoors around entrances.	
Fleas (cat & dog)	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol	Apply to infested areas.	Keep infested dogs and cats out of the house. Dust pets thoroughly with commercial flea powders.
	chlorpyrifos	0.5% ready-to-use solution	0.5% ready-to-use solution		Do not apply to pets or man.
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
Houseflies	pyrethrum	Ready-to-use aerosol	Ready-to-use aerosol	Apply as required as a space spray.	Ensure that doors and windows are screened. Keep garbage in tightly sealed containers to prevent fly breeding.
	permethrin	Ready-to-use aerosol	Ready-to-use aerosol		
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
	dichlorvos	Slow release strip or block	Slow release strip or block		
Centipedes, sowbugs, spiders, silverfish	chlorpyrifos	0.5% ready-to-use solution	0.5% ready-to-use solution		
	diazinon 12½ %EC	50 mL/L water	1 fl oz/pint water	Apply to cracks, crevices and other hiding places and surfaces where pests are found.	

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where to Apply	Remarks and Precautions
Centipedes, sowbugs, spiders, silverfish	malathion (premium grade) 83.6%EC	50 mL/L water	1 fl oz/pint water		
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol		
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
Larder beetles	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol	Apply to storage areas where larvae are found.	Destroy infested food. Clean storage areas before spraying.
Stored food insects, flour beetles	malathion (premium grade) 83.6%EC	50 mL/L water	1 fl oz/pint water	Spray storage shelves thoroughly. Packaged foods can be returned to shelves when spray has dried.	Destroy infested food and clean storage area before spraying.
	propoxur	1% ready-to-use aerosol	1% ready-to-use aerosol		
Strawberry root weevil	malathion 50%EC	50 mL/L water	1 fl oz/pint water	Apply around entrances of buildings to prevent entry.	
Wasps, hornet, bumble bees	malathion 50%EC	50 mL/L water	1 fl oz/pint water	Direct sprays into entrance holes of nests.	Spray in early morning or late evening when insects are in their nests. Wear mosquito netting, gloves, etc. to prevent strings.
	propoxur	Pressurized pencil spray	Pressurized pencil spray		

FARM BUILDINGS

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
GOOD SANITATION AND EARLY APPLICATION OF INSECTICIDES ARE THE KEYS TO AN EFFECTIVE FLY CONTROL PROGRAM.				
Housefly	FLY BANDS AND STRIPS			
	dichlorvos	Suspend 1 insect strip/ 30 m^3 air space. Replace after 3 months.	Suspend 1 insect strip/ 1000 ft^3 of air space. Replace after 3 months.	
	SCATTER BAIT			
	dichlorvos	Scatter 125 g of 0.25% bait/50-100 m^2 on floors, alleyways, doorways, window sills. Repeat as required.	Scatter ¼ lb of 0.25% bait/500-1000 ft^2 on floors, alleyways, doorways, window sills. Repeat as required.	Do not use in milk rooms or milk processing rooms.
	methomyl	Scatter 125 g of 1% bait/50-100 m^2 to areas where flies congregate.	Scatter ¼ lb of 1% bait/500-1000 sq ft to areas where flies congregate.	Do not apply where birds or animals have access to bait. Avoid direct contact with skin.
	propoxur	Scatter ready-to-use bait using 250 g bait/100 m^2	Scatter ready-to-use bait using 1/2 lb bait/1000 sq ft.	
	trichlorfon	Scatter 1% bait using 125 g bait/100 m^2	Scatter 1% bait using 1/4 lb/1000 sq. ft.	
	RESIDUAL WALL SPRAYS			
	diazinon	Mix 1.9 L of 50%EC in 100 L water and apply 5-10 L mixture/100 m^2 at 3-4 week intervals. Walls, windows and other fly resting areas should be treated.	Mix 15 fl oz of 50%EC in 5 gal water and apply 1-2 gal mixture/1000 ft^2 at 3-4 week intervals. Walls, windows and other fly resting areas should be treated.	Remove animals before spraying and keep them out at least 4 hours after spraying.
	dimethoate	Mix 2.5 L 4E/100 L water. Apply 5 L mixture/50-100 m^2. Repeat as necessary. One application will provide up to 8 weeks control.	Mix 20 fl oz 4E/5 gal water. Apply 1 gal mixture/500-1000 ft^2. Repeat as necessary. One application will provide up to 8 weeks control.	Remove livestock and poultry before spraying. Do not contaminate feed, litter or water.
	permethrin	Mix 40-80 mL permethrin 25%EC or 100-200 mL 10%EC or 200-400 mL 5%EC/10 L water and apply to point of run off to areas where flies congregate.	Mix 0.6-1.25 fl oz 25%EC or 1.5-3.25 fl oz 10%EC or 3.25-6.5 fl oz 5%EC per gallon of water and apply to point of run off to areas where flies congregate.	Remove animals before spraying.
	tetrachlorvinphos	Mix 1-2 kg 50% WP/50 L water. Apply 5-10 L mixture per 100 m^2.	Mix 2-4 lb 50% WP/11 gal water. Apply 1-2 gal mixture per 1000 sq. ft.	Do not treat freshly white-washed surfaces.

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
Housefly	trichlorfon	Mix 160 g 80%SP in 100 L water and apply 5 L mixture/50 m. Apply to floors, walls, ceilings, around windows and other areas where flies congregate. Better residual control may be obtained by adding 100 g of sugar/L of mixture.	Mix 6 lb 4 oz 80%SP in 40 gal water and apply 1 gal mixture/500 ft^2. Apply to floors, walls, ceilings, around windows and other areas where flies congregate. Better residual control may be obtained by adding 1 lb of sugar/gal of mixture.	
SPACE SPRAYS	pyrethrin	Apply ready-to-use pyrethrin mixtures as a mist or space spray or from automatic dispensers. Close doors & windows for about 10 minutes after spraying.	Apply ready-to-use pyrethrin mixtures as a mist or space spray or from automatic dispensers. Close doors & windows for about 10 minutes after spraying.	

FEED LOTS

Host and Pest	Insecticide	Metric	Imperial Measure	Restrictions
Housefly	malathion	Apply 850-1000 mL malathion 50%EC/ ha. as a fog or aerosol.	Apply 12-14 fl oz malathion 50%EC/ ac. as a fog or aerosol.	
	pyrethrins	Apply ready-to-use mixture containing 0.25% pyrethrins as a thermal fog.	Apply ready-to-use mixture containing 0.25% pyrethrins as a thermal fog.	
	permethrin	Mix 40-80 mL 25%EC or 100-200 mL 10%EC or 200-400 ml 5%EC/10 L water and apply to areas where flies congregate.	Mix 0.6-1.25 fl oz 25%EC or 1.5-3.25 fl oz 10%EC or 3.25-6.5 fl oz 5%EC per gallon of water and apply to areas where flies congregate.	

STORED GRAIN INSECTS

Pest and Location	Insecticide	Metric	Imperial Measure	Rate of Application	Remarks
RUSTY GRAIN BEETLE, RED FLOUR BEETLE, SAWTOOTHED GRAIN BEETLE, GRANARY WEEVIL					
Empty Bins	malathion	60 mL 50%EC/L water	10 fl oz 50%EC/ 1 gal water	5 l/100 m^2 (1 gal/ 1000 ft^2)	Apply to inside surfaces of bins. Wait one day before filling.
FUMIGATION OF GRAIN IN STORAGE	aluminum phosphide	Ready-to-use tablets	Ready-to-use tablets	180 tablets or 300 pellets 35 m^3 (1000 bu) inject tablets evenly throughout grain.	Wax coating on tablets prevents release of gas for 4 hours after opening container. Phosphine is a very toxic gas; seal granary and post warning signs. Work in pairs. Use only when grain temperature is above 5°C (40°F).
	*Fumigation Period Grain Temperature 4°C-12°C 12°C-15°C 16°C-20°C			Fumigation Period 10 days 5 days 4 days	Following fumigation, aerate bins for 48 hours or until odor dissipates. Grain can be used for livestock feed following aeration.
CONTROL BY COLD TEMPERATURES	Rusty grain beetles and other stored grain insects can be killed by periods of cold temperatures as follows: Grain Temperature - 5°C - 10°C - 15°C			Time Required to Kill Insects 6 weeks 4 weeks 2 weeks	
	Grain temperatures can be lowered by aeration. Moving grain several times during cold weather may lower temperatures enough to kill insects.				